

# University Research Week St. Albert's Day

April 19<sup>th</sup> and 20<sup>th</sup>, 2022

9:00 a.m. - 3:30 p.m.

Ahmanson Ballroom Harper Center



## **HISTORY OF ST. ALBERT'S DAY AT CREIGHTON UNIVERSITY**

In 1997, faculty from the health science schools, as well as from the College of Arts and Sciences, expressed an interest in promoting the interaction between faculty scientists and students at Creighton University at both the undergraduate and graduate level. A series of discussions resulted in the first St. Albert's Day celebration, which was held on November 24, 1997. Since 1997, the St. Albert's Day poster session has been an annual event at Creighton University. In 2008, the event was expanded to include oral (platform) presentations as well as posters. Awards will be presented for the 'best poster' in three categories, as well as for the 'best presentation.'

St. Albert the Great was born in 1205 or 1206, and as a youth was sent to pursue his studies at the University of Padua. He joined the Order of St. Dominic in 1223. He completed a doctor's degree at the university in Paris, which was celebrated as a school of theology. In 1254 Albert was elected Provincial of his Order in Germany. He resigned this office in 1257 in order to devote himself to study and to teaching. He was canonized in 1331. He is the patron saint of scientists and was the mentor of St. Thomas Aquinas. He was called the "Doctor Universalis" (Universal Doctor), in recognition of his extraordinary genius and extensive knowledge. He composed a veritable encyclopedia that contained scientific treatises on almost every subject. He was proficient in every branch of learning cultivated in his day, including physics, mathematics and metaphysics, and his writings did not distinguish between the sciences and philosophy.

# CREIGHTON ST. ALBERT'S DAY SCHEDULE OF EVENTS

## Tuesday April 19

### 9:00-11:00 AM

Poster Presentations	Harper Ballroom
School of Medicine Poster Presentations	Harper Ballroom
Oral Platform Presentations	Harper 2045/2046

### 11:00-1:30 PM

Medical Student Luncheon and Abstract Awardee Presentations	Harper 4068/4069
--	------------------

### 1:30-3:30PM

Poster Presentations	Harper Ballroom
Oral Platform Presentations	Harper 2045

### 3:30PM

Three Minute Thesis Presentations	Harper 4068/4069
-----------------------------------	------------------

## Wednesday April 20

### 9:00-11:00AM

Poster Presentations	Harper Ballroom
Oral Platform Presentations	Harper 2045
	Harper 4068/4069
Distance Students Zoom Link	Below (Two Links)

### 11:30AM

Research Award Luncheon	Harper 2057/2058
-------------------------	------------------

Please click the link below to join the webinar:

<https://creighton.zoom.us/j/96750635657?pwd=THlaSzBjcDZURnZTSEEwbjJMVnJ4Zz09> Passcode: **470208**

**INDEX OF MORNING POSTER PARTICIPANTS**  
**9:00-11:00 AM**  
**TUESDAY, APRIL 19, 2022**

<b><u>STUDENT:</u></b>	<b><u>POSTER NUMBER:</u></b>	<b><u>STUDENT:</u></b>	<b><u>POSTER NUMBER:</u></b>
Grace Jaworski	1	Brooke McGill	37
Olivia Nicholson	2	Madeline Nottoli	38
Erin Hebert	2	Danielle-Aditi Raikar	39
Jackson Fox	3	Patrick Kuwong	40
Gretchen Jones	4	Garrett Manion	41
Adam Wilson	5	Claire Willman	42
Jackson Parks	6	Colleen Glennon	44
Julie Srail	7	Ross Johnson	45
Aaron Marta	8	Zachary LeBaron	46
Carly Baker	8	Michelle Swedek	47
John Quigley	9	Pooja Kasinath	48
Emily Klawiter	10	Graison Sitenga	49
Aimee Schreiner	11	Peter Granger	50
F. Taghizadeh	11	Tiffany Chu	51
Cong Tian	12	Sarah Eversman	52
Justin Rudd	13	Eugen Moon	53
William Swenson	14	Sam Shea	54
Laura Cogua	15	Charissa Lau	55
Tyler Woodward	16	Swapnil Shah	56
Nethra Viswaroopan	17	Dillon Polito	57
Ivy Williams	18	Dillon Polito	58
Demi Brown	19	Thomas Gossard	59
William Brausch	20	Vincent Eaton	60
David Law	21	Julia Biagini	61
Jenny Grissom	22	Morgan Hopp	62
Harsh Uppala	23	Cuyler Dewar	63
Spencer McKinley	24	Xinxin Wu	64
Lauren Jenson	25	Ursulina Tomczak	65
Jocelyn Plowman	26	Julia Drexelius	66
Olivia Salas	27	Margaret M. McCann	67
Maria Kleinsmith	28	Claire Tolan	68
Michelle Wyley	29	Bridgett Nelson	70
Tess Hofstra	30	William B. Meier	71
Stephanie Schafer	31	Michelle Ngo	72
Alayna Ritter	32	Rachel Wright	73
Francesca Toste	33	Noel Morgan	74
Adriana Oh	34	Dana Eitan	75
David Law	35	Dorothy Kenny	76
Gabby O'Connor	36		

## INDEX OF AFTERNOON POSTER PARTICIPANTS

1:30 – 3:30 PM

TUESDAY, APRIL 19, 2022

<b><u>STUDENT:</u></b>	<b><u>POSTER NUMBER:</u></b>	<b><u>STUDENT:</u></b>	<b><u>POSTER NUMBER:</u></b>
Alyzza Vitug	1	Joseph Newton	20
Grace Heithold	2	Rachael Urquhart	21
Ben Engle, Ben	3	Benhamin Folz	22
Moynul Islam	4	Jacob Rapoza	23
Rachel E. Johnson	5	Arij Khan	24
Seraphine Kamayirese	6	Bayode Ibironke	25
Katie Huisman	7	Conner Peebles	26
Michelle Marie Helmeke	8	Melanie Schwengler	27
Ansley Atkinson	8	Katherine Lemke	28
Hunter Weitzel	9	Nicholas Herrero	29
Mia N. Morrissey	10	Samuel J. Rogers	30
Jackson Parks	11	Erika Jank	31
Destiny Jordan	12	Matthew Meyer	32
Neal Sinha	13	J.M. King	33
Paul McCaslin	14	Mae Grahek	34
Nathan Jobalia	15	Cami Bizal	35
Ally Thavenet	16	Ashleigh Furey	36
Elizabeth Kettler	17	Amanda Edwards	37
Nik Johnson	17	Eliana Rodriguez	38
Armond J. Isaak	18	Grace O. Putz	39
Alyssa Thallemer	19	Sofia Deatherage	40
Linh Bui	19	Molly Kleist	41

**INDEX OF MORNING POSTER PARTICIPANTS**  
**9:00-11:00 AM**  
**WEDNESDAY, APRIL 20, 2022**

<b><u>STUDENT:</u></b>	<b><u>POSTER NUMBER:</u></b>	<b><u>STUDENT:</u></b>	<b><u>POSTER NUMBER:</u></b>
Madeleine Urbanek	1	Adam Taylor	28
Shreshtha Dash	2	Kylie Machida	29
Amanda Cohen	3	Sukhman Viridi	30
Kennedy-Kainoa			
Tamashiro	4	Allison Benoit	31
Curtis Lin	5	Israel Bryant	32
Jessica Jagelski	6	Jeffrey Brozek	33
Emily Fraser	7	Haylee Hudson	34
Libbie Smith	8	Megan Rothberg	34
Lauren Ross	8	Aya Cote	35
Haley Frazee	8	Elise Choquette	36
Allison Benjamin	8	Maria O'Brien	37
Keely Orndorff	9	Megan Eiberger	37
Patrick Herchenbach	10	Leanna Fronckowiak	38
Kelly S. Johnson	11	Katie Sandquist	39
Nathan Yoshida	12	Katie Cunningham	40
Elizabeth Baker	13	Ellen So	41
Isaac Young	14	Amber Schwarting	42
Kyle McGuire	15	Martyna Adamiec	43
Armaan Kumar	16	Emma Travis	44
Rebecca Powers	17	Nicholas Garcia	45
Nik Johnson	18	Miguel Sanchez	46
Megan Dalicandro	19	Rutuja Gadgil	47
Abigail Bercich	20	Emily Fraser	48
Blake Murphy	21	Maya Day	49
Jacqueline Kay	22	Morgan Day	50
Rebecca Black	23	Kevin Boes	51
Yashmita Malhotra	24	Eve Aspenwell	52
Quintin Muhlenkamp	25	Olivia Kiernan	53
Tyler Farr	26	Emily Unsen	53
Alicia Nguyen	27	James Barry	53
		Karen Crouch	54

**INDEX OF ORAL PLATFORM PARTICIPANTS  
TUESDAY, APRIL 19, 2022**

<b><u>STUDENT:</u></b>	<b><u>TIME:</u></b>	<b><u>ROOM NUMBER:</u></b>
Caroline Pass	9:00 AM	Harper 2045
Christian Wilhelm	9:15 AM	Harper 2045
Alexandra Van Cleave	9:30 AM	Harper 2045
Nora Martin	9:45 AM	Harper 2045
Cindy Selig	10:00 AM	Harper 2045
Jason Hulen	10:15 AM	Harper 2045
Joseph A. Kostansek IV	9:00 AM	Harper 2046
Olivia Raspotnik	9:15 AM	Harper 2046
Rhiannon McCracken	9:30 AM	Harper 2046
Thomas V. Evans	9:45 AM	Harper 2046
Richard D. Lutze	10:00 AM	Harper 2046
Samantha Draves	10:15 AM	Harper 2046
Sarah Tooley	10:30 AM	Harper 2046
Caitlin Frie	1:30 PM	Harper 2045
Collin Jackson	1:45 PM	Harper 2045
Nathan Zimmerman	2:00 PM	Harper 2045
Nina Crabtree	2:15 PM	Harper 2045
Presley Kimball	2:30 PM	Harper 2045
Segewkal Hawaze Heruye	2:45 PM	Harper 2045
Shreshtha Ray	3:00 PM	Harper 2045

**INDEX OF ORAL PLATFORM PARTICIPANTS  
WEDNESDAY, APRIL 20, 2022**

<b><u>STUDENT:</u></b>	<b><u>TIME:</u></b>	<b><u>ROOM NUMBER:</u></b>
Anne Hubbard	9:00 AM	Harper 2045
Courtney P. Rudick	9:15 AM	Harper 2045
Hayden M. Hubbs	9:30 AM	Harper 2045
Tavian Sanchez	9:45 AM	Harper 2045
Renju Pun	10:00 AM	Harper 2045
Shawn Freed, Jr.	10:15 AM	Harper 2045
Yohan Walter	10:30 AM	Harper 2045
Jaylin Tuman	10:45 AM	Harper 2045

## DISTANCE PRESENTATIONS STUDENT ABSTRACTS

ZOOM LINK: [HTTPS://CREIGHTON.ZOOM.US/J/93966788561](https://creighton.zoom.us/j/93966788561)

<b><u>STUDENT:</u></b>	<b><u>TIME:</u></b>
Ellie Bacon	9:00AM
Jennifer Kennedy	9:15 AM
Mari Ogino	9:30 AM
Hope Signa	9:45 AM
Hannah Wirtz Murphy	10:00 AM

### ZOOM LINK:

[HTTPS://CREIGHTON.ZOOM.US/J/97480833162?pwd=DM9NDLNxVZDUZ01DBDDRDDL1SVC3UT09](https://creighton.zoom.us/j/97480833162?pwd=DM9NDLNxVZDUZ01DBDDRDDL1SVC3UT09)

<b><u>STUDENT:</u></b>	<b><u>TIME:</u></b>
Cody Cooper	9:00AM
Megan Eiberger	9:15 AM
Treva Rice	9:30 AM
Tanner Strommen	9:45 AM
Jaclyn Taylor	10:00 AM

## **SUMMER FACULTY FELLOWSHIP RECIPIENTS**

Dr. Sabrina Danielsen  
Dr. Vanessa Minervini

Dr. David Mullins  
Dr. Matthew Reznicek

Dr. Sarah Walker  
Dr. Aaron Yamada

## **HADDIX RESEARCH SCHOLAR RECIPIENTS**

Dr. Michael Belshan  
Dr. Melinda Burnett  
Dr. Stephen Gross  
Dr. Kelley Hammond  
Dr. Andrew Hogan

Dr. Amanda Holman  
Dr. Jee-Yeon Hwang  
Dr. David McPherson  
Dr. Erika Moreno  
Dr. Mark Robinson

Dr. Regina Taylor  
Dr. Sijing Wei  
Dr. Richard Witmer

## **CURAS FACULTY RESEARCH FUND PARTICIPANTS**

Dr. Amy Badura Brack  
Dr. Candace Bloomquist  
Dr. Charles Bockman  
Dr. Kevin Estep  
Dr. Kelley Hammond

Dr. Amanda Holman  
Dr. Marty Hulce  
Dr. Matthew Huss  
Dr. Dawn Irlbeck  
Dr. Vanessa Jewell

Dr. Cristina Pop  
Dr. Juliane Strauss-  
Soukup  
Dr. Dustin Stairs  
Dr. Ryan Wishart

## **CLARE BOOTH LUCE RECIPIENTS**

Madelyn Anderson  
Clara Coughlan-Smith  
Emma Goldsmith

Kristin Holmes  
Emily Klawiter  
Allison Larsen

Abigail Mollison  
Rebecca Powers  
Madeleine Urbanek

## **CURAS UNDERGRADUATE RESEARCH RECIPIENTS**

### ***COLLEGE OF ARTS AND SCIENCES***

#### ***DEAN'S SUMMER UNDERGRADUATE RESEARCH SCHOLARS***

Russ Brausch	Amanda Edwards	Keegan Kalkman
Julia Crawford	Ashleigh Furey	Elizabeth Peller
Marie Day	Mae Grahek	John Quigley
Lauren Dominello	Grayson Huldin	Sarah Tooley

#### ***COLLEGE ARTS AND SCIENCES HONORS PROGRAM SUMMER UNDERGRADUATE RESEARCH FELLOW***

Noah Keime

#### ***DR. AND MRS. RANDOPLH FERLIC SUMMER UNDERGRADUATE RESEARCH FELLOWS***

Lauren Barbush	Jack Rausch	Will Swenson
Eli Blaney	Zachery Rinke	Kennedy-Kainoa
Ally Einbeck	Tavian Sanchez	Tamashiro
Lauren Jenson	Benjamin Schauer	Sukhman Viridi
Evan Johnson	Neal Sinha	Hunter Weitzel

#### ***CURAS DIRECTOR'S SUMMER UNDERGRADUATE RESEARCH FELLOWS***

Amanda Cohen	Joshua Fernandes	Nicholas Sande
	Jenna Royce	

#### ***DEPARTMENT OF HISTORY SUMMER UNDERGRADUATE RESEARCH FELLOW***

Eve Aspinwall

**POSTER PRESENTATIONS: 9:00-11:00 AM  
TUESDAY, APRIL 19, 2022  
STUDENT ABSTRACTS**

**1** *Determining the Thermodynamics of the Interaction Between PCNA and the PIP Motif of CAF-1*

**Grace Jaworski**, Grace Majeres, and Dr. Lynne Dieckman

Department of Chemistry and Biochemistry; Creighton University, Omaha, NE

Replication-coupled nucleosome assembly is the process of packaging DNA into nucleosomes immediately after DNA synthesis. The organization of nucleosomes determines whether genes within these nucleosomes are expressed or silenced. This pathway requires two major proteins: proliferating cell nuclear antigen (PCNA) and chromatin assembly factor 1 (CAF-1). Although the interaction between CAF-1 and PCNA is critical for the silencing of genes, a lot of information is unknown about how these two proteins interact to allow replication-coupled nucleosome assembly to occur. Almost all proteins that interact with PCNA do so using a PCNA interacting protein (PIP) motif. The goal of these studies was to characterize the thermodynamics of the interaction between PCNA and the PIP motif of CAF-1. The thermodynamic parameters were measured using isothermal titration calorimetry (ITC), which is a technique that measures temperature change produced during a protein-protein interaction. From these studies, we determined that the PIP of CAF-1 binds to PCNA with a binding affinity ( $K_d$ ) of 430 nM, an enthalpy change ( $\Delta H$ ) of -1.86 kcal/mol, a free energy change ( $\Delta G$ ) of -8.68 kcal/mol, and a stoichiometry of 1.3:1 for PCNA:PIP. This binding affinity is similar to that of PCNA with the PIPs of other proteins involved in DNA-templated processes. Future studies will include determining the thermodynamics of binding with mutant forms of PCNA and the PIP of CAF-1 to better understand the role of this interaction during replication-coupled nucleosome assembly.

**2** *Single Molecule Studies of Nucleosome Assembly Proteins Using TIRF Microscopy*

**Oliva Nicholson, Erin Hebert**, and Dr. Lynne Dieckman

Department of Chemistry and Biochemistry; Creighton University, Omaha, NE

Shortly after replication, newly synthesized DNA is packaged and stored in structures called nucleosomes, which are the fundamental units of chromatin. Nucleosomes are composed of double-stranded DNA wrapped around eight histone proteins. This packaging process, called replication coupled nucleosome assembly, is crucial for protecting DNA and maintaining genomic stability. Two proteins that play major roles in this process are chromatin assembly factor-1 (CAF-1), a heterotrimeric histone chaperone protein that brings histone proteins to DNA for nucleosome assembly, and proliferating cell nuclear antigen (PCNA), which binds and recruits CAF-1 to the replication fork. The interaction between PCNA and CAF-1 is essential for proper DNA synthesis and gene silencing; however, the specific mechanism of binding is unknown. We are using protein-protein binding studies to determine the kinetics and binding affinity of the CAF-1-PCNA interaction. Specifically, we are developing total internal reflection fluorescence (TIRF) microscopy assays to measure this interaction on the single-molecule scale. Thus far, we have built a TIRF microscope system and are currently optimizing these assays to verify the detection of fluorescently labeled PCNA binding to immobilized CAF-1. Future studies will include using these TIRF assays to determine the binding kinetics of the CAF-1-PCNA interaction, thereby increasing our understanding of the nucleosome assembly process.

### 3 *Kinetics of Novel Mycobacterium Tuberculosis Inhibitors*

**Jackson Fox**, Dr. E. Jeffrey North, and Dr. Lynne Dieckman

Department of Chemistry and Biochemistry; Creighton University, Omaha, NE

*Mycobacterium tuberculosis* (M. tb) is a bacterium that is spread through the air, affecting the brain, lungs, and kidneys of roughly 10 million individuals each year. Over time, multidrug-resistant (MDR) and extensively drug resistant (XDR) strains of M. tb have been emerging that are resistant to the most common M. tb treatments. With the rise in MDR and XDR strains of M. tb, there is an ample need for novel treatments. The membrane of M. tb contains unique, long-chained fatty acids called mycolic acids. FadD32 is an enzyme involved in the biosynthesis of mycolic acids, making FadD32 a potential target for novel inhibitors. Coumarin-based compounds have been identified to inhibit the function of FadD32; however, these inhibitors have extremely short half-lives. We have synthesized novel compounds with similar structures to the previously known inhibitors, which have increased stability and half-lives. Additionally, enzyme kinetics studies show some of these new compounds have maintained potent inhibition of FadD32. These studies suggest these new compounds may be novel inhibitors of FadD32 and may ultimately lead to new treatments for MDR and XDR strains of M. tb.

### 4 *Halophiles as Bioindicators for Road Salt Exposure, Part 3*

**Gretchen Jones**, Gracely Briley, Ally Hansen, Michael Brown, and Tyson Gorach

Department of Biology, Creighton University, Omaha, NE

Halophiles are salt-tolerant bacteria and archaea that can be used as bioindicators for road salt exposure. We quantified the density and identity of halophilic microbes in soil samples collected in southeast Nebraska. Site locations included continuous salt-exposed sites, seasonal salt exposed roadways, unexposed sites, and potentially exposed sites considered more ecologically sensitive. Density of microbes was determined by a modified spot test on halophilic media. The identity of halophilic bacteria was performed by polymerase chain reaction (PCR) of the 16S rDNA of isolated halophilic colonies, followed by Sanger sequencing of the PCR products. The results of this project may shed light on the impact of road salt on soil microbial communities and could impact salt use decisions near waterways and other ecologically sensitive ecosystems.

### 5 *Reproductive Ecology of Water-Pollinated Stuckenia pectinata*

**Adam Wilson**

Department of Biology, Creighton University, Omaha, NE

Water-pollination, or hydrophily, occurs when a flower releases pollen that then floats along the water's surface to another flower or back to the flower that released the pollen. Water-pollination is a rare method of pollen transfer demonstrated in a handful of flowering plant families. Hydrophilous plants provide food and habitat, but also attenuate waves and are primary producers in aquatic environments. Increased knowledge of water-pollination enables people to better maintain ecosystem health and better understand the traits that facilitate hydrophilous plants' success. Despite the key roles that hydrophilous plants fulfill, information about hydrophilous traits is lacking, especially regarding the development of pollen after it arrives at a flower. Such information is key to understanding the reproductive consequences of a shift from a terrestrial environment to an aquatic environment. Post-pollination development is shaped by selection on pollen and carpel traits, including those that determine the ability of flowers to self-pollinate and pollinate other flowers. Data regarding post-pollination events will enable cross-comparisons between hydrophilous plants and other plants with different pollination systems to understand the key traits that allow water-pollination to be a viable pollination transfer mechanism. To obtain information about water-pollination, a water-pollinated plant, *Stuckenia pectinata*, was examined to characterize the morphology of the carpel, determine fruit set, and determine self-pollination efficiency versus cross-pollination efficiency. The results were compared to other hydrophilous plants, such as *Ruppia maritima*, to understand key adaptations of hydrophilous plants in relation to other flowering plants.

**Acknowledgements:** Christie Dang, Neha Lamsal, Monroe Pruett and Mackenzie L. Taylor

## 6 *Halophiles as Bioindicators for Road Salt Exposure, Part 1*

**Jackson Parks**, Adam Taylor, Taylor York, Elizabeth Myster, and Francesca Toste

Department of Biology, Creighton University, Omaha, NE

Halophiles are salt-tolerant bacteria and archaea that can be used as bioindicators for road salt exposure. We quantified the density and identity of halophilic microbes in soil samples collected in southeast Nebraska. Site locations included continuous salt-exposed sites, seasonal salt exposed roadways, unexposed sites, and potentially exposed sites considered more ecologically sensitive. Density of microbes was determined by a modified spot test on halophilic media. The identity of halophilic bacteria was performed by polymerase chain reaction (PCR) of the 16S rDNA of isolated halophilic colonies, followed by Sanger sequencing of the PCR products. The results of this project may shed light on the impact of road salt on soil microbial communities and could impact salt use decisions near waterways and other ecologically sensitive ecosystems.

## 7 *Analysis of Pollen Tube Growth in Pondweed (*Stuckenia pectinata*)*

**Julie Srail**, Dr. Mackenzie Taylor, Emma Baker, and Caleb Williams

Department of Biology, Creighton University, Omaha, NE

Pondweed (*Stuckenia pectinata*) is in the minority of angiosperms that exhibit hydrophily, or water pollination. Despite this rare pollination syndrome, pondweed is an extremely common freshwater plant, causing the lack of literature on its reproductive ecology to be more striking. In this experiment we pollinated pondweed by hand in the greenhouse and collected samples at 15-minute consecutive timepoints. Then we observed the flowers under a UV microscope. Next, we measured pollen tube length to calculate pollen tube growth rate. We also recorded ovule entry to determine time to fertilization. This will give us critical information about the reproductive ecology of this ubiquitous and unique angiosperm.

## 8 *Carnitine Shuttle Enzyme CPT II and its Effect on Neural Development Through Changed Metabolic Signaling*

**Aaron Marta**<sup>1</sup>, **Carly Baker**<sup>2</sup>, Nathan Zimmerman<sup>1</sup>, Thiago Mattos<sup>3</sup>, Zeljka Korade<sup>3</sup>, and Annemarie Shibata<sup>1</sup>

<sup>1</sup>Department of Biology, Creighton University, Omaha, NE; <sup>2</sup>Department of Biomedical Sciences, Creighton University Medical School Omaha, NE; <sup>3</sup>Child Health Research Institute, University of Nebraska Medicine. In early development, long chain fatty acid (LCFA) catabolism via beta-oxidation functions as an alternative pathway to glucose, and in areas such as the brain, LCFA catabolism is preferred. In normal LCFA catabolism, the carnitine shuttle protein carnitine palmitoyltransferase II (CPTII), facilitates the conversion of palmitoylcarnitine to palmitoyl-CoA. However, when there is a deficiency of CPT II protein, the disruption of LCFA catabolism leads to pathology characterized by neurodevelopmental abnormalities, muscle weakness, and reduced fatty acid oxidation. Though the mechanism by which CPT II deficiency contributes to neuropsychological disorders is not known, we hypothesize that CPT II deficiency prevents proper brain and whole-body development as the result of dysfunctional metabolic signaling. Using a zebrafish model system to study the effect of CPT II deficiency on brain development and behavior, we knocked down CPT II expression in wildtype TuAB zebrafish during early development. Knockdown of CPT II was performed by microinjecting translation blocking and splice blocking morpholino constructs at the single cell stage. Knockdown of CPTII results in cardiac edema, curved tails, decreased body length, abnormal eye, and telencephalon development. Alcian blue and oil red staining of 5 dpf larvae reveals abnormal cartilage development and lipid deposition, respectively. Huc/d and acetylated tubulin immunohistochemistry shows disrupted neuronal and neural network development, respectively. Behavioral quantization and tracking analyses of 5 dpf larval show significantly decreased activity and freezing responses in CPTII deficient zebrafish compared to controls. Total acylcarnitine levels were increased significantly in 5 dpf knockdown larvae. Further studies will determine how CPTII deficiency affects neural network function using electrophysiology analyses. Our work shows structural and behavioral differences between zebrafish when CPTII function and LCFA catabolism is disrupted indicating a relationship between brain development and metabolic signaling.

**9** *Halophiles as Bioindicators for Road Salt Exposure, Part 2*

**John Quigley**, Frank Lonie, Sebastian Respicio, Troy Bulusan, and Katriyn Williams

Department of Biology, Creighton University, Omaha, NE

Halophiles are salt-tolerant bacteria and archaea that can be used as bioindicators for road salt exposure. We quantified the density and identity of halophilic microbes in soil samples collected in southeast Nebraska. Site locations included continuous salt-exposed sites, seasonal salt exposed roadways, unexposed sites, and potentially exposed sites considered more ecologically sensitive. Density of microbes was determined by a modified spot test on halophilic media. The identity of halophilic bacteria was performed by polymerase chain reaction (PCR) of the 16S rDNA of isolated halophilic colonies, followed by Sanger sequencing of the PCR products. The results of this project may shed light on the impact of road salt on soil microbial communities and could impact salt use decisions near waterways and other ecologically sensitive ecosystems.

**10** *Horsehair Worm Diversity, Aquatic Insect Diversity and Water Quality in Creeks Near Lincoln, NE*

**Emily Klawiter**, Nicholas Fitzgerald, Emily Churness, and John Shea, S.J., Ph.D.

Department of Biology, Creighton University, Omaha, NE

Atrazine is an herbicide widely used throughout the United States and has been found to reduce biodiversity in aquatic ecosystems. Atrazine is widely used throughout Nebraska, and this project aimed to examine the impacts of atrazine on insect biodiversity in streams near Lincoln, NE because aquatic insects can serve as indicators of ecosystem health. Aquatic insects also serve as intermediate hosts for parasites such as horsehair worms. During the summer of 2021, aquatic insect samples were collected via strainer collection and colonization or tiles at 50 aquatic sites near Lincoln, NE. Strainer samples were collected twice at each site in consecutive weeks, and tiles were placed and left for colonization for one week. Horsehair worms and snails were collected at each of the sites, and snails were dissected to count and identify horsehair worm cysts. Water samples were also collected twice at each site to test for atrazine presence and various additional water parameters as well. Collected insects were separated by order and Shannon Diversity Indices were calculated for each of the sites. Shannon Diversity Indices ranged from 0.29 to 1.72 for insects. Lower indices indicate less biodiversity, and it was found that biodiversity varied greatly between sample sites. Insect diversity was compared to cyst prevalence of horsehair worms at multiple sites as well as compared to atrazine presence. Further analysis and collection of data is required, but if horsehair worms can be used as indicators of ecosystem health, a positive correlation between cyst prevalence and diversity is expected when compared to insect diversity and water quality.

## 11 *MyD88 Regulates Expression of TLR4 and TRPV1 at the Plasma Membrane*

**Aimee Schreiner, F. Taghizadeh<sup>a</sup>, Cong Tian, Kylee Sutton, and Peter Steyger**

Translational Hearing Center, Department of Biomedical Sciences, Creighton University, Omaha, NE;

<sup>a</sup>Oregon Hearing Research Center, Oregon Health & Science University, Portland, OR

Aminoglycosides remain clinically necessary to treat bacterial infections that elicit severe systemic inflammation. Unfortunately, parenteral administration of these drugs can cause permanent hearing loss following entry into mammalian sensory hair cells via non-selective cation channels, such as TMC1, TRPA1 and TRPV1. Bacteriogenic-induced activation of TLR4 (via lipopolysaccharides, LPS) upregulates and sensitizes TRPV1 channels increasing cellular uptake of aminoglycosides and thereby exacerbating hearing loss (Jiang et al., 2019). LPS binding of TLR4 activates an intracellular signaling cascade via the adaptor protein, MyD88, while the loss of TLR4, TRPV1 or MyD88 activity ameliorates severe inflammation and drug-induced hearing loss. (Jiang et al., 2019; unpublished data). We hypothesize that MyD88 facilitates internalization of, and/or a conformational change, in plasmalemmal TRPV1 to increase cellular uptake of aminoglycosides.

The TRPV1 agonist, capsaicin, enhances, while the TRPV1 antagonist capsazepine attenuates, cellular uptake of GTTR, with or without MyD88 or TLR4 knockdown, suggesting that plasmalemmal TRPV1 is functional independent of MyD88 or TLR4 expression. However, after MyD88 knockdown, cells (with or without LPS treatment) had reduced uptake of GTTR compared to their control cells. MyD88 knockdown increased TRPV1 expression that is further elevated by LPS exposure, suggesting that MyD88 is required for TRPV1 internalization and degradation. Also, increased MyD88 and TRPV1 protein expression after LPS treatment is attenuated after TLR4 knockdown. In PLA experiments, MyD88-TRPV1 and TLR4-TRPV1 interactions are increased after LPS treatment. Knockdown of MyD88 attenuated LPS-induced degradation of TLR4 expression observed in MyD88<sup>+</sup> cells in immunoblots. This suggests that LPS-increased internalization of TLR4 is dependent on MyD88, as previously demonstrated.

Our data suggest that MyD88 traffics a TLR4-TRPV1 complex away from the membrane, while knockdown of MyD88 prevents this internalization - 'trapping' these proteins at the plasma membrane. These results implicate that MyD88 activity is required for inflammation-exacerbated aminoglycoside-induced cytotoxicity and hearing loss.

## 12 *The Effect of a Viral-Induced Inflammation Model on Cochlear Uptake of Aminoglycosides*

**Cong Tian, Aimee B. Schreiner, Kylee M. Sutton, and Peter S. Steyger**

Department of Biomedical Sciences, Creighton University, Omaha, NE

**Background:** The effect of virogenic inflammation on drug induced ototoxicity is unknown. This study tests whether a TLR7 agonist (gardiquimod) induces COVID-19-like inflammation and modulates cochlear and serum levels of aminoglycosides. We tested different gardiquimod doses to compare their efficacy in inducing inflammation. We also tested different doses of gardiquimod to determine if specific doses increase cochlear uptake of gentamicin, an ototoxic aminoglycoside, without modulating serum levels of gentamicin.

**Methods:** C57BL/6 mice received DPBS (control) or gardiquimod (1-20 mg/kg) through i.v. injection (N≥4 per group). Three and 24 hours later, blood and cochlear tissues were collected to obtain cytokine expression levels via qRT-PCR or Luminex multiplex ELISA assays, including: IFN $\alpha$ , IFN $\beta$ , IFN $\gamma$ , MCP1, MIP1 $\alpha$ , NF $\kappa$ B, TNF $\alpha$ , IP10, IL1 $\alpha$ , IL1 $\beta$ , IL2, IL6, IL10, IL12 $\alpha$ , and IL12 $\beta$ . To determine the effect of gardiquimod-induced inflammation on inner ear and serum concentrations of gentamicin, C57BL/6 mice received DPBS (control) or gardiquimod (up to 20 mg/kg) (N=6 per group), and 24 hours later, mice received gentamicin for 1 hour via i.p. injection. Blood and cochlear samples were collected to evaluate gentamicin levels using a gentamicin ELISA kit.

**Results:** Gardiquimod induced dose-dependent inflammatory responses, with increased serum and cochlear levels of cytokines that are associated with COVID-19 infections in humans, e.g., IP10, MCP1, MIP1 $\alpha$ , IL6, TNF $\alpha$ , compared to DPBS groups. Inflammatory responses at 24H were reduced compared to that 3H after treatment. We found that gardiquimod increased cochlear levels of gentamicin in a dose-dependent manner, but gardiquimod dose had no effect on serum levels of gentamicin.

**Conclusions:** Our data show that gardiquimod induced a robust inflammatory response that mimics viral infection-induced inflammation in humans. Furthermore, we showed that a wide range of gardiquimod doses increased cochlear, but not serum, levels of gentamicin. Thus, activated TLR7 signaling could increase the risk of ototoxin-induced hearing loss.

13 *hFWE3-Overexpressing cSCC Cells Induce Mitotic Spindle Dysfunction in “Losing” Neighbors to Promote Competitive Delamination*

**Justin Rudd**, Rachel E. Johnson, and Laura A. Hansen

Department of Biomedical Sciences, Creighton University, Omaha, NE

**Background:** Cancer cells utilize transmembrane “fitness fingerprints” called Flower (hFWE) proteins to direct selection of aggressive populations within tumors. Previously, we demonstrated that cSCC cells overexpressing the hFWE3 isoform eliminate neighboring “loser” cSCC cells by inducing their delamination; however, the mechanisms by which this non-autonomous detachment is executed remain unclear. Here, we describe phenotypic and molecular characteristics of the “loser” cell state and utilize a targeted CRISPR screen to uncover novel mediators of hFWE3-driven competitive elimination.

**Hypothesis:** We hypothesized that hFWE3 overexpressing cSCC cells induce non-autonomous dysregulation of adhesion-related gene expression in neighbors to promote their delamination, and that CRISPR-mediated reversal of these alterations in adhesion would prevent competitive elimination.

**Results:** “Losing” mCherry+ SCC13 (WT-R) cells cocultured with hFWE3 expressing cSCC (hFWE3-G) exhibited loss of adhesion ( $p < 0.001$ ), clonogenicity ( $p < 0.05$ ) and broad transcriptomic changes (3407 DEG  $p\text{-adj} < 0.05$ ), but did not undergo cell cycle arrest or apoptotic death. Cell cycle ontologies, including “Mitotic Cell cycle” (FDR  $5.4\text{E-}20$ ), and adhesion ontologies including “Structural molecule activity” (FDR  $2.00\text{E-}3$ ), were enriched in “loser” cell downregulated genes. *COL8A1*, exhibited strong downregulation in “losers” ( $-2.3\text{x}$ ;  $p\text{-adj } 2.6\text{E-}05$ ), an effect validated in qPCR ( $-3.8\text{x}$ ;  $p < 0.001$ ) and immunoblotting ( $-1.28\text{x}$ ), but CRISPRa-based *COL8A1* rescue had modest impact on “loser” elimination (3.1% rescue,  $p > 0.05$ ) while promoting population expansion cell-autonomously (10.5%,  $p < 0.01$ ). CRISPRa screening of downregulated genes in “losers” revealed a pattern of positive selection for sgRNAs targeting mitotic spindle components (*MCPH1*, *PDE4DIP*, *NUF2*, *HAUS7*, *CENPF*, *NUP37*).

**Conclusions:** These data suggest that hFWE3 expressing cells eliminate neighboring “losers” by altering their adhesive and clonogenic properties in a process that does not require overt cell cycle arrest or apoptotic cell death. Functional screening indicates that these phenotypic “loser” cell changes may result from non-autonomous mitotic spindle dysregulation, which could act to promote asymmetric division events which produce more differentiated daughter cells.

14 *Syntheses and Structures of Mixed-Metal Sulfites - The Facile Linking of Hard and Soft Metals via the Sulfite Ligand*

**William Swenson** and Eric Villa, PhD

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Over the past few decades research into the lanthanide elements has increased, but there is still a vast unexplored portion of the complexing and coordination chemistry they entail. Lanthanides in coordination with the sulfite anion have the potential to link with soft transition metals. Furthermore, this sector of lanthanide chemistry can complex with organic ligands to expand upon the potential profitable and innovative regions of magnetism, luminescence, and catalytic processes. It is important to create a more facile understanding of the fundamental chemistry and bonding conditions behind these syntheses. Within this study we were able to discover five novel mixed metal lanthanide rhodium sulfite complexes related to two previously synthesized compounds. Although potential applications of these compounds are unknown, they all express diverse ranges of stability and versatility in formation. Synthesis of each compound is most greatly recognized at hydrothermal temperatures in an aqueous environment. Crystallography unit cell data was used to determine the structure and respective data for each compound. We hope to demonstrate the importance of the fundamental chemistry of these mixed-metal sulfites, two of which involving an organic ligand, compounds and develop a more facile method of reproduction and study.

## 15 *Synthesis, Uv-Vis Properties and Antimicrobial Evaluation of Multivalent 1,2,3-Triazolium Salts*

**Laura Cogua** and James T. Fletcher

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Triazolium salts are quaternary ammonium compounds (QACs) that have been shown to exhibit antibacterial and antifungal properties, which vary depending on the identity of their substituents. The purpose of this study was to evaluate the antimicrobial activity of triazolium QACs as the arene center is varied, and to optimize potency through variation of N-triazolium and aryl substituents. Aryl azide compounds were synthesized with varying n-butyl, and diethyl substituents. These aryl azides were reacted with p-diethynylbenzene, 1,4-diethynylnaphthalene, 1,6-diethynylpyrimidine, 1,5-diethynylnaphthalene and 2,6-diethynylnaphthalene using a base-catalyzed click reaction to form 1,5-disubstituted-1,2,3-triazole analogs. A library of triazolium salts was prepared by the di-substitution of either 1-iodobutane, 1-iodopentane, 1-iodohexane, 1-iodoheptane, 1-iodooctane or benzyl bromide groups at the N3 position of each triazole ring. A total of 31 molecules were made and analyzed for UV-Vis and antimicrobial properties by performing microdilution minimum inhibitory concentration (MIC) assays against Gram-positive bacteria, Gram-negative bacteria, and yeast. MIC activity indicated a maximum potency of 0.4  $\mu$ M against Gram-positive bacteria, 0.8  $\mu$ M against Gram-negative bacteria and 1.6  $\mu$ M against yeast. MIC potency for gram negative bacteria was enhanced by the presence of 1-iodoheptane on the N3 position. Disubstituted salts with naphthalene connectivity proved to have the highest MIC potency. Details regarding the synthesis, characterization, UV-Vis properties and antimicrobial assays of these compounds will be presented.

**Acknowledgements:** This publication was made possible by grants from the National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH), and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

## 16 *Cell-free Biosynthesis of the Lasso Peptide Klebsidin*

**Tyler Woodward** and Benjamin Brandsen, PhD

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Antibiotic resistance is a serious and growing problem, and the discovery of new antibiotics is critical in the fight against antibiotic-resistant pathogens. One exciting source of new antibiotics is ribosomally synthesized and post-translationally modified peptides (RiPPs). Many RiPPs possess potent antibiotic activity against closely related microbes and engineering the pathways that produce these compounds could be a rich source of new antibiotics. Here, we report cell-free biosynthesis conditions for the lasso peptide klebsidin, a RiPP identified from the bacteria *Klebsiella pneumoniae* with antibiotic activity against *K. pneumoniae*. The klebsidin biosynthetic pathway is extremely tolerant of mutations in precursor peptide substrates, but cellular export for some of these peptide variants may prove inefficient, leading to inhibition of host cell growth. To decouple lasso peptide biosynthesis and cellular growth, we developed conditions for robust cell-free biosynthesis of klebsidin, optimizing DNA concentration, T7 RNA polymerase concentration, reaction component composition, and reaction time. Using these optimized conditions, we demonstrate production of wild type klebsidin, a single amino acid variant of klebsidin, and chimeras of klebsidin and other lasso peptides, highlighting the potential of cell-free biosynthesis to produce novel lasso peptide products.

## 17 *Analysis of Topical Cosmetic Powder and Powder Compact Formulations*

**Nethra Viswaroopan**, Neha S. Panchabhai, Amey S. Sukhia, and Justin A. Tolman

Department of Pharmacy Sciences, Creighton University School of Pharmacy and Health Professions, Omaha, NE

**Objective:** Cosmetic powders, specifically setting and finishing powders, are intended to hold makeup in place, while also containing oil wicking properties. The quality of these powders depends on characteristics such as adsorption power to the skin, mattifying ability, compaction hardness, and more. This pilot project aims to explore the feasibility of topical cosmetic powder formulations using various binders. Binders have a strong influence on overall powder quality dependent on type and amount.

**Methods:** Preliminary powder formulations were characterized by particle size analysis. These formulations were then compressed into loose compacts followed by characterization. Powder compact formulations were prepared using wet or dry binders at varying levels.

**Results:** Particle size distribution data shows larger particle sizes having a better finishing product and prevent breakage better when compacted. Compacted powders were subjected to hardness, friability, slip, and adsorption tests to distinguish quality. Uniform for all binders used, excessive amounts of binder caused decreased slip and adsorption to skin, while trace amounts of binder disrupt the compaction capabilities of the powder.

**Conclusion:** Binder selection and binder concentration within the formulation substantially affected powder compact properties. A critical balance is needed to retain the integrity of the powder compact while still retaining better-quality powder dispersion for topical application.

**18** *Expression of OBP-14 Concentration in Different Age and Castes of Apis Mellifera in Correlation to Odorant Functional Coding*

**Ivy Williams**, Shreeya Mishra, Amanda Lee, and Madeline Bushong

Center for Undergraduate Research (CURAS), Creighton University, Omaha, NE

Like all honeybees, *Apis mellifera* utilizes odorant binding proteins to sense and express chemical stimuli. Their olfactory system is important for them to communicate amongst themselves. We will be analyzing the concentrations of odorant binding protein 14 (OBP-14) in each caste and age group. There are five different types of bees we will inspect: pupae, hatchling, nurse, forager, and drone. Each has its own unique role in the hive. RNA will be extracted from the bees and run through the process of digital droplet polymerase chain reactions (ddPCR). This quantifies the amount of OBP-14 in each bee, which will enable us to compare the data statistically. We hope to discover if there is a correlation between a bee's caste function and concentration of OBP-14.

**19** *Rearrangement Reactions of Ether-Containing 1,3,4-Trisubstituted-1,2,3-Triazolium Salts*

**Demi Brown** and James. T Fletcher

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

1,3,4-Trisubstituted-1,2,3-triazolium salts are quaternary ammonium compounds (QACs) that exhibit antibacterial and antifungal activity. The effectiveness of the antimicrobial activity varies depending on substituent identity. It was previously observed that 1,3,4-trisubstituted-1,2,3-triazolium bromide salts with aryl ether groups at the C4 position undergo relatively rapid rearrangement resulting in the scrambling of N1 and N3 benzyl groups. The purpose of this study was to observe the impact that substituent identity and reaction time have on this rearrangement process. Benzyltriazoles with phenoxymethyl, 4-tert-butylphenoxymethyl, methoxymethyl and phenylethyl groups at the C4 position were prepared using azide-alkyne cycloaddition. The exchange of benzyl and 4-tert-butylbenzyl groups at the N1 and N3 positions of such triazolium bromide salts was studied by mass spectrometry and NMR spectroscopy. It was determined that rearrangement rates were strongly promoted by the presence of ether functionality at the C4 position and also moderately impacted by both ether and benzyl group substituent identity. Those analogs that could be prepared cleanly were tested for antimicrobial activity using microdilution minimum inhibitor concentration (MIC) assays against Gram-positive bacteria, Gram-negative bacteria, and yeast. Details regarding the rearrangement reactions and antimicrobial assays of these compounds will be presented. This publication was made possible by grants from the National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH), and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

**20** *Neural Cell Adhesion Molecule and Myosin Heavy Chain Co-Expression in Parkinson's Disease and Older Adults*

**William Brausch** and Kelley G. Hammond, PhD

Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE

Skeletal muscle cells undergo denervation and reinnervation as they age. The most marked motor unit remodeling is demonstrated by type II muscle fibers during the aging process. Neural cell adhesion molecule (NCAM) is a membrane-bound glycoprotein which is expressed during the reinnervation of a muscle fiber following denervation. The literature suggests that the remodeling process for neurologically-normal aging muscle differs from that of older adults with Parkinson's disease (PD).

**Purpose:** The intent of this project is to determine the occurrence of motor unit remodeling in the vastus lateralis (VL) muscle of persons with PD compared to age-matched older adults by evaluating NCAM expression. The first aim of the study was to develop and optimize an immunohistochemistry (IHC) protocol to successfully identify NCAM expression in human skeletal muscle specimens. The second aim of the study will be to evaluate co-expression of NCAM and myosin heavy chain (MHC; to identify fiber type).

**Methods:** Muscle tissue samples were previously collected by percutaneous needle biopsy of the right *m. vastus lateralis* under local anesthesia using a 5-mm Bergstrom-type biopsy needle with suction. Fresh-frozen cryo-sections were incubated in specific primary and secondary antibodies to detect NCAM and laminin expression.

**Results:** Preliminary results suggest a slight increase in NCAM expression in PD vs older adults, but further analysis is ongoing. Observationally, NCAM expression in PD appears more random, while expression in older adults appears more localized.

**Future Directions:** After optimizing the protocol for the staining of NCAM, we will look to add additional myosin heavy chain primary antibodies to the staining protocol. This will allow us to quantify the occurrence of co-expression of NCAM production with MHC in both PD and old adult skeletal muscle.

## 21 *Developing Optimal Doses of 6N-Cyclohexoadenosine and 5,Adenosine Monophosphate to Induce a Hypometabolic State in Cultured hFOB Osteoblasts*

**David Law**<sup>1</sup>, Nik Johnson<sup>1</sup>, Elizabeth Kettler<sup>1</sup>, Megan Dalicandro<sup>1</sup>, Jake Siedlik<sup>1</sup>, Mitchel Magrini<sup>1</sup>, Joan Eckerson FACS<sup>1</sup>, Kristen Drescher<sup>2</sup>, and Eric Bredahl<sup>1</sup>

<sup>1</sup>Department of Exercise Science & Pre-Health Professions, <sup>2</sup>Department of Medical Microbiology and Immunology, Creighton University, Omaha, NE

Maintaining bone mineral density during prolonged microgravity exposure is key for long-term survival and preservation of functional capacity. A potential approach to minimize bone loss is to slow the enzymatic processes that underly bone mineral density degradation. Altering the activity of adenosine receptors can create a system-wide change towards hypometabolism, thereby slowing metabolic and enzymatic activity.

**Purpose:** To characterize and identify the optimal dose of 5' adenosine monophosphate (5AMP) and N<sup>6</sup>-cyclohexyladenosine (CHA) to induce a state of artificial metabolic depression in cultured hFOB osteoblasts.

**Methods:** hFOB osteoblasts were cultured in growth medium (90% DMEM 10% FBS) until they reached 90-95% confluency. Cells were then seeded onto a 96-well plate at a density of 10,000 cells/ml with fresh growth media and incubated for 24 TIRFhr prior to experimentation. Cells were then exposed to growth media containing either CHA or 5AMP at varying doses. Cell viability was assessed immediately after incubation via a Nikon live cell confocal imaging system. Oxygen consumption and glycolytic activity were assessed using ELISA based assays.

**Results:** Both 5AMP and CHA reduced metabolic activity. Furthermore, at the optimal doses, there was no significant change in cell viability.

**Conclusion:** Initial evidence suggests that CHA and 5AMP can create a moderate degree of metabolic depression.

## 22 *Design and Synthesis of Novel Phenylalanine- and Tyrosine-based Antimycobacterial Agents*

**Jenny Grissom** and E. Jeffrey North

School of Pharmacy and Health Professions, Creighton University, Omaha, NE

Tuberculosis (TB) is one of the leading causes of death worldwide from just a single infectious agent (*Mycobacterium tuberculosis*). Non-tuberculous mycobacteria (NTM) and tuberculous mycobacteria have increasingly shown the need for developing novel anti-mycobacterial agents that could i) reduce treatment timeline, ii) be more effective, and iii) increase efficacy against drug-resistant strains as resistance arises to the first line therapeutic agents. Previously, the North lab discovered highly potent and substituted indole-2-carboxamides (IC) that are active against NTM, and TB drug resistant strains, however, this scaffold has

poor solubility in aqueous environments. This led to the current design of amino acid-based analogs to improve their solubility by achieving a better balance of lipophilicity and hydrophilicity while maintaining the antimycobacterial pharmacophore. The goal of this project was to synthesize phenylalanine and tyrosine-based antimicrobials with various lipophilic head groups that demonstrated high potency in the IC series. Final products were characterized by  $^1\text{H}$  NMR,  $^{13}\text{C}$  NMR, and mass spectrometry. These final products will undergo further microbiological with subsequent cytotoxicity evaluation to identify leading antimicrobials for further development.

## **23** *Dynamic Light Scattering in Potassium Borate Glass Melts*

**Harsh Uppala**

Department of Physics, Creighton University, Omaha, NE

We report dynamic light scattering measurements performed on potassium borate glass melts at temperatures near the glass transition. Borate glass melts provide a platform to study structural effects on fragility and non-exponentiality, given their ability to vary their bond density when alkali is added to the mixture. Photon correlation spectroscopy was performed on boron oxide melts doped with 0-10% potassium oxide by mole fraction. This data provides insight into the structure factor of liquid  $\alpha$ -relaxation, from which both fragility and non-exponentiality can be characterized. Two relaxations were observed, the first of which we attribute to be the viscoelastic  $\alpha$ -relaxation, typical of most liquids, while the second we attribute to potassium ion diffusion within the glass melt.

**Acknowledgement:** Dr. David Sidebottom

## **24** *Fluorescent Morphometry and Microgravity for Terrestrial and Space Medical Research*

**Spencer McKinley**

Department of Physics, Creighton University, Omaha, NE

Microgravity, the condition of apparent weightlessness, causes bone, muscular and immune system dysfunctions in astronauts following spaceflights. These organ and system-level dysfunctions correlate with changes induced at the single cell level both by simulated microgravity on earth as well as microgravity conditions in outer space (as in the international space station). Reported changes in single bone cells, muscle cells and white blood cells include structural/morphological abnormalities, changes in gene expression, protein expression, metabolic pathways and signaling pathways, suggesting that cells mount some response to microgravity. Using a rotary cell culture system invented by NASA for the simulation of microgravity, we expose various cancer cell lines to microgravity conditions and quantify the morphologic changes in the cells using fluorescence-based morphometry. Since the primary mechanism by which animal cells sense microgravity is still unclear, our work aims at quantifying microgravity-induced phenotypic changes in cells with a view to exploring the mechanism(s) of cellular response to microgravity so as to use microgravity as a potent biophysical constraint for terrestrial and space medical research.

**Acknowledgement:** Dr. Andrew Ekpenyong

## 25 *Schizophrenia and NMDA Receptors in Astrocytes*

**Lauren Jensen**, Dinesh Gawande, and Shashank Dravid

Department of Pharmacology and Neuroscience, Creighton University, Omaha, NE

A plethora of neurons are constantly communicating with each other in the human brain and glutamate receptors play key roles in those communications. As the previous Dopamine Hypothesis of Schizophrenia is not able to account for all symptoms seen in schizophrenic pathology, glutamate receptors dysfunction has been identified as a possible mechanism for pathology. NMDA receptors are glutamate receptors in post-synaptic neurons and astrocytes. Previous research has shown that lower function of NMDA receptors may underlie symptoms of psychotic disorders. When NMDA receptors are blocked, they almost entirely recapitulate symptoms of schizophrenia including psychosis, cognitive deficits, and affective symptoms. The prefrontal cortex region of the brain is particularly associated with these dysfunctions.

There is evidence to support that dysfunction of the GluN2C subunit of the NMDA receptor in the prefrontal cortex is related to schizophrenic-like behaviors. First, lower GluN2C expression was found in the prefrontal cortex of postmortem brain tissue obtained from schizophrenia patients. Secondly, genetic deletion of the GluN2C subunit in mice produces many behavioral changes relevant to schizophrenia. Changes in prefrontal cortex function such as excitation-inhibition balance and oscillatory disturbances are also observed upon GluN2C ablation. The GluN2C subunit is exclusively expressed in astrocytes and not neurons in the cortical regions of the brain. However, the role of NMDA receptors and the GluN2C subunit in astrocytes and their contribution to schizophrenic-like phenotypes is unknown. This project examined the role of the GluN2C subunit in astrocytes in schizophrenic-like behaviors.

A battery of behavioral tests was performed on GluN1 KO and WT mice to test psychotic, cognitive, and negative symptoms. GluN1 KO mice presented with hypolocomotion, lowered MK-801 induced hyperlocomotion, increased anxiety, and working memory problems. As this project was limited to GluN1 KOs, future studies should conduct the battery of behavioral tests on GluN2C KOs.

## 26 *Characterization of KMT5B Heterozygous Mutation in Cell Cycle Progression and DNA Damage Repair*

**Jocelyn Plowman**, Rochelle N. Wickramasekara, Samuel P. Anderson, Brynn W. Robertson, and Holly A. F. Stessman

Department of Pharmacology and Neuroscience, Creighton University, Omaha, NE

**Background:** Mutations in *KMT5B* are typically associated with developmental and language delay, intellectual disability, and autism spectrum disorder. Recently, *KMT5B* has been implicated in cancer. *KMT5B*, a lysine methyltransferase, is responsible for the di-methylation of histone 4 lysine (K) 20. Histone modifications influence cell cycle regulation, DNA replication, and DNA damage repair. Histone methylation is considered an important mark of cancer. The H4K20me2 mark has been implicated in many cancer mechanisms and found to have aberrant/irregular expression in many cancer types. In addition to irregular expression of H4K20me2, decreased *KMT5B* expression has been found in various cancers, such as gastrointestinal, reproductive, hematopoietic, and lymphatic.

**Hypothesis:** The goal of this study was to characterize the effect(s) of *KMT5B* haploinsufficiency in the regulation of the cell cycle and DNA damage repair processes in cancer. We hypothesize that truncating *KMT5B* mutations will result in cell cycle progression and DNA damage response deficits.

**Materials and Methods:** CRISPR/Cas9 genome editing was used to create permanent heterozygous, truncating mutations in the K562 cell line to mimic what is likely represented in *KMT5B* patient cells. Single cell clones were isolated, and mutations were confirmed with Sanger sequencing. RNA expression was analyzed using qRT-PCR, and RNA sequencing was used to identify gene and isoform expression differences between *KMT5B*<sup>+/+</sup> (WT) and three *KMT5B*<sup>+/-</sup> cell lines. Cell cycle analyses were performed using BrdU and flow cytometry, and Cell Titer-Glo and Caspase 3/7 assays were used to test the sensitivity of DNA-damaging agents (ionizing radiation, hydroxyurea, and etoposide).

**Results:** Three *KMT5B*<sup>+/-</sup> frameshifting (containing 13, 14, and 2 bp deletions, respectively) cell lines were created and compared to WT. qRT-PCR data confirmed decreased *KMT5B* expression in all mutants. RNA sequencing showed that gene signatures of epithelial-mesenchymal transition (EMT) and chemotaxis regulation were highly enriched in mutants, which are processes thought to be important for cancer

progression. For one mutant, we observed an increase in G1 and G2/M phase cells and a decrease in S phase cells compared to WT. No significant differences in cell cycling were observed in the other mutants. While no significant differences were noted in response to ionizing radiation, mutants were more sensitive to hydroxyurea and etoposide than WT in CellTiter-Glo and Caspase-Glo 3/7 assays, yet to different degrees.

**Conclusion:** Differences were observed in gene expression, cell cycle progression, sensitivity to DNA damaging agents, and DNA double-strand break repair across the *KMT5B*<sup>+/-</sup> cell lines compared to *KMT5B*<sup>+/+</sup>. This suggests that *KMT5B* may help regulate cell cycle progression and DNA damage repair processes in cancer.

## 27 *Fluorescence-Guided Morphometry in Radioimmunotherapy for Brain Tumors*

**Olivia Salas**, Yohan Walter, Anne Hubbard, Allie Benoit, Erika Jank, and Dr. Andrew Ekpenyong  
Department of Physics, Creighton University, Omaha, NE

**Problem:** Glioblastoma is one of the most aggressive forms of brain cancer and has dismal survival rates. We studied the efficacy of radioimmunotherapy against glioblastomas, using fluorescence-guided morphometry.

**Methods:** Cells were cultured using standard sterile technique and later treated with a combination of carbon quantum dots and irradiation. Following treatment, cells were stained with fluorescent dyes, Hoechst and Calcein for imaging. Once imaged, cells were quantitatively and qualitatively analyzed using ImageJ's fractal analysis plugin, FracLac.

**Results:** Circularity did not give definitive results about the efficacy of radioimmunotherapy, but lacunarity of cells 24 hours post-treatment indicated onset of treatment efficacy. Our results show that cells irradiated at 10 Gy and treated with carbon quantum dots display significantly different ( $p < 0.001$ ) lacunarity from cells treated with only carbon quantum dots in the 24 hours following treatment. Further analysis on varied treatment combinations and time windows post-treatment will be examined.

**Conclusions:** These findings suggest that circularity may not be an accurate measure of radioimmunotherapy efficacy as there are no significant trends across treatment conditions. Our preliminary results for lacunarity consolidate clonogenic assays and suggest that a combination of therapeutic modalities may be effective in treating radioresistant cancers such as glioblastoma.

## 28 *Reliability of and Relationship Between Rate of Muscle Activation and Rate of Torque Development in Persons with Parkinson's Disease and Older Adults*

**Maria Kleinsmith**, Mitchel A. Magrini, Mae Grahek, Elise Choquette, Jacob A. Siedlik, and Kelley G. Hammond

Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE

Parkinson's Disease (PD) is a disorder which affects the central nervous system, causing gradual loss of motor control. Symptoms vary among individuals and based on the progression of the disease, but it is common for individuals with PD to experience resting tremor, fatigue, dyskinesias, and muscle stiffness.

**Purpose:** To determine the reliability and relationship between rate of torque development (RTD) and rate of electromyography (EMG) rise in persons with PD and non-impaired older adults (OA).

**Methods:** Twenty-three persons (PD=12; OA=11) volunteered to complete two maximal voluntary isometric contractions (MVIC) of the quadriceps femoris on two days (>48 hrs apart). Participants were instructed to kick against the ankle cuff "as hard and fast as possible" for each MVIC trial. Participant's torque and muscle electromyography (EMG) were collected simultaneously and were analyzed offline using a custom written software to examine peak torque (PT), peak RTD (pRTD), peak EMG (pEMG), and peak rate of EMG rise (pRER). Differences PT, pRTD, pEMG, and pRER, between PD and OA were analyzed using Bonferroni-corrected independent samples t-tests with a significance value set at  $p \leq 0.05$ . Pearson correlation analyses were used to analyze the relationship between dependent variables in PD, OA, and with collapsed groups. ICC estimates and their standard error were calculated using statistical software based on a mean-rating ( $k=3$ ), absolute-agreement, 2-way mixed-effects model.

**Results:** PT (PD=126.8±44.5 Nm; OA=134.5±60.3 Nm), pRTD (PD=488.6±319.3 Nm·s<sup>-1</sup>; OA=687.8±552.3 Nm·s<sup>-1</sup>), pEMG (PD=0.12±0.07 mV; OA=0.09±0.04 mV), and pRER (PD=1.11±0.64 mV·s<sup>-1</sup>; OA=0.99±0.75 mV·s<sup>-1</sup>) were similar in PD and OA ( $p > 0.05$ ). PT is positively correlated with pEMG in collapsed groups ( $r=0.425$ ,  $p=0.043$ ) and in OA ( $r=0.813$ ,  $p=0.002$ ), but not in PD ( $r=0.259$ ,  $p=0.417$ ). The reliability of PT is poor in collapsed groups ( $ICC_{3,1}=0.368\pm62.09$ ) and PD ( $ICC_{3,1}=-0.373\pm87.18$ ), but excellent in OA ( $ICC_{3,1}=0.896\pm26.93$ ). The reliability of pEMG is moderate in collapsed groups ( $ICC_{3,1}=0.717\pm0.07$ ) and PD ( $ICC_{3,1}=0.513\pm0.06$ ), but good in OA ( $ICC_{3,1}=0.807\pm0.07$ ). pRTD is positively correlated with pRER in collapsed groups ( $r=0.639$ ,  $p=0.001$ ) and in OA ( $r=0.823$ ,  $p=0.002$ ), but not in PD ( $r=0.453$ ,  $p=0.139$ ). The reliability of pRTD is only moderate in PD ( $ICC_{3,1}=0.511\pm261.16$ ), but is good in collapsed groups ( $ICC_{3,1}=0.862\pm269.85$ ) and OA ( $ICC_{3,1}=0.887\pm298.24$ ). The reliability of pRER is poor in collapsed groups ( $ICC_{3,1}=0.458\pm0.80$ ) and PD ( $ICC_{3,1}=0.027\pm0.90$ ), but good in OA ( $ICC_{3,1}=0.657\pm0.78$ ).

**Conclusions:** The reliability and relationships of PT, pRTD, pEMG, and pRER are quite robust in OA, even to the point of maintaining the reliability and relationships when OA are collapsed with PD. However, the poor reliability of these variables in PD may impede the relationships among these variables in this population. Still, there is no difference in PT, pRTD, pEMG, and pRER between PD and OA, which may suggest a peripheral neuromuscular issue in PD, limiting the reliability and relationships between measures of torque and EMG in both absolute and rate measures.

**Practical Applications:** The mechanism(s) leading to poor reliability of torque and EMG measures need further investigation. A resistance training intervention may increase neural connectivity and efficiency, possibly improving the consistency of the PD neuromuscular system's output.

29

### *Elevated Urine Osmolality and Specific Gravity are Associated with Increased Small Intestinal Permeability*

**Michelle Wyley**, Sarah Hansberry, Andrew Culp, Hadi Alchommali, Joseph Braun, and G. Patrick Lambert  
Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE

**Purpose:** The intent of this study was to determine whether hydration status (based on urine osmolality and specific gravity) influences small intestinal permeability. Intestinal permeability refers to the unmediated transport of large, normally restricted substances (e.g., bacteria) across the intestinal barrier. Increased intestinal permeability may lead to gastrointestinal symptoms and/or disorders.

**Methods:** Twelve healthy college-aged individuals (age = 21 +/- 1 yrs.; 8 females, 4 males), screened for health and gastrointestinal issues, reported to the laboratory with a sterile urine sample after an overnight fast greater than or equal to 8 hours. Upon entering the laboratory, they ingested a 150 mL solution that contained 5 grams of lactulose (L) and 2 grams of mannitol (M). For the following 5 hours, they collected their urine in a urine collection container. This urine was analyzed for lactulose and mannitol, which are commonly used probes to determine intestinal permeability. From the lactulose and mannitol concentrations and the amount of urine produced, the 5-hour urinary excretion of each probe was determined, and the L/M ratio was calculated. The L/M ratio is an indicator of intestinal permeability.

**Results:** The 5-hour urine osmolality and specific gravity were significantly correlated with the L/M ratio ( $r = 0.664$  and  $r = 0.75$ , respectively;  $p < 0.05$ ).

**Conclusion:** The results indicate that increasing urine osmolality and specific gravity (i.e., dehydration) may be associated with small intestinal permeability in healthy young adults.

**Acknowledgements:** CURAS Faculty Research Fund at Creighton University

30

### *The Effects of a 6-Week Hippotherapy Program in Irritability and Social Behavior of Children with ASD*

**Tess Hofstra**, M. Ekstrum, M. Vanden Heuvel, M. Almazloum, K. Peck, K. Smith, K. King, E. Godden, D. Katsavelis, and A. Kyvelidou  
Department of Physical Therapy, School of Pharmacy and Health Professions, Creighton University, Omaha, NE

**Introduction:** The incident of autism spectrum disorder (ASD) has increased dramatically the past few decades. Hippotherapy (HPOT) is a treatment option that has shown promises for various developmental

disabilities, such as cerebral palsy, developmental delay and ASD among others. The aim of this study was to determine the effects of a six-week HPOT intervention on caregiver's perception of their child's social behavior and behavioral disturbance. Specifically, we used the Social Responsiveness Scale (SRS) and the Aberrant Behavior Checklist (ABC).

**Methods:** Nine children diagnosed with ASD aged between 5-10 years old and their caregivers, filled out pre- and post-assessments for the SRS and ABC Scale. Participants were recruited from the community. Pre- and post-HPOT assessments were taken in a room near the barn at the Heartland Equine Therapeutic Riding Academy while the HPOT sessions took place inside the barn.

**Results:** A paired t-test was performed on the scores from the pre- and post-assessments for the SRS and the ABC Scale. The results showed that out of the 5 subscales of the ABC Scale, irritability was significantly reduced in children with ASD after the intervention ( $p=0.008$ ), with a large effect size (Cohen's  $d=1$ ). On the SRS Questionnaire, the Overall Score ( $p=0.01$ ), Social Cognition ( $p=0.01$ ), Social Communication ( $p=0.03$ ), and Restricted Interests/Repetitive Behaviors ( $p=0.03$ ) showed significant improvements after the intervention with moderate to large effect sizes.

**Conclusions:** Even a 6-week HPOT program showed improvements in social and irritability behaviors of children with ASD as exhibited with the SRS Questionnaire and the ABC Scale.

### 31 *How Do Health Professions Students Make Decisions About Using Over-the-Counter Medications? A Cross-Sectional Survey Study*

**Stephanie Schafer**, Shayna Skokan, Lauren Ruggles, Katherine Kjendal, and Cameron Bizal

Advisor: Kevin Fuji, PharmD, MA

School of Pharmacy and Health Professions, Creighton University, Omaha, NE

**Objective:** To characterize the use of over-the-counter (OTC) medications by pharmacy, occupational therapy (OT), and physical therapy (PT) students, and examine factors associated with their OTC decision-making process.

**Methods:** A cross-sectional online survey design was used. A self-developed online survey was distributed to all pharmacy, OT, and PT students ( $n=1,101$ ) at a private, Midwestern university in Spring 2021.

**Results:** A total of 244 students completed the survey (22.2% response rate) with similar response rates across programs. Respondents indicated that cost ( $n=208$ , 85.2%), prior product experience ( $n=190$ , 77.9%), and symptom severity ( $n=178$ , 73.0%) were the most important factors when selecting OTC medications. When faced with novel symptoms, more pharmacy students would use community pharmacists for symptom interpretation compared to OT and PT students (37.4% vs. 16.3% vs. 14.0%, respectively) ( $p<.001$ ) and for OTC medication selection (49.6% vs. 22.1% vs. 20.9%,  $p<.001$ ). More PT students would use non-healthcare family members to interpret symptoms compared to OT and pharmacy students (46.5% vs. 34.9% vs. 17.4%, respectively) ( $p<.001$ ) and for OTC medication selection (44.2% vs. 31.4% vs. 11.3%,  $p<.001$ ). When faced with familiar symptoms, more pharmacy students would use community pharmacists to interpret symptoms compared to OT and PT students (42.6% vs. 17.4% vs. 16.3%,  $p<.001$ ), for OTC medication selection (56.5% vs. 27.9% vs. 25.6%,  $p<.001$ ), and to guide use of the selected medication (53.0% vs. 30.2% vs. 32.6%,  $p=.002$ ). More OT and PT students would use non-healthcare family members for OTC medication selection compared to pharmacy students (20.9% vs. 18.6% vs. 7.0%,  $p=.011$ ).

**Implications/Conclusions:** Professional differences emerged in the resources that would be used to interpret symptoms, select an OTC medication, and determine how to use the selected medication. Despite increased focus on interprofessional education, there appears to still be a lack of understanding regarding the expertise of community pharmacists in addressing minor medical ailments.

### 32 *Inhibition in Children With and Without ADHD Abstract*

**Alayna Ritter**

Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE

Children with ADHD and without ADHD tend to score the same in terms of behavioral data when performing inhibitory tasks. To better understand the neural mechanism underlying ADHD this study used a Go-No-Go

inhibitory task at both high and low frequency to exploit differences in brain activation between studied groups. During the task participants will wear a Functional Near-Infrared Spectroscopy (fNIRS) cap, measuring hemodynamic response based on time from source detector. We expect children with ADHD to show differences in neural activation profiles during the task compared to children without ADHD, especially in low frequency trials. Additionally, we expect no noticeable behavioral differences in efficiency (accuracy and RT) for participants with ADHD compared to the typically developing groups. This study expanded on previous work showing differences in channel activation of the left and right parietal cortex between TD and ADHD groups.

### 33 *"I'm Really Fine": An Exploration of Mental Health Perceptions Among Postpartum Women in Rural Communities*

**Francesca Toste<sup>1</sup>**, and Kailey Snyder, PhD<sup>2</sup>

Department of Biology, Creighton University, Omaha, NE

**Background:** After childbirth it is common for women to experience postpartum depression or "baby blues" as a result of physiological and psychological changes associated with childbirth. Postpartum depression symptoms may include anxiety, mood swings, trouble sleeping, or even recurrent thoughts of death and suicide. With the stigmatization of mental health, especially in rural communities, it is important to better understand women's self-reported perceptions related to their mental health after childbirth.

**Purpose:** To explore mental health perceptions of postpartum women in rural communities using a sequential explanatory mixed methods design.

**Methods:** Quantitative data (e.g., surveys) was collected followed by qualitative data (e.g., interviews) among a cohort of postpartum (<6 months since childbirth) individuals who lived in a community of <50,000 people. Participants (n=366) were asked to complete the Edinburgh Perinatal Depression Scale (EPDS). A cohort of 30 women were then asked to engage in a semi-structured interview. Quantitative data was analyzed using EPDS standard scoring protocol and qualitative data analyzed via a deductive content analysis.

**Results:** The mean score of the EPDS was  $14.5 \pm 4.4$ ; 140 participants (36.6%) scored  $\leq 13$  points while 243 participants (63.4%) scored  $\geq 14$  points indicating probable depression of varying severity. Thematic qualitative findings revealed postpartum individuals reported brief discussions of their mental health with their primary care provider at their 6-week postpartum visit. Participants saw family and partners as effective sources of support and most reported being satisfied with their knowledge and resources related to mental health. Most viewed their current mental state as satisfactory or "fine."

**Conclusion:** This study determined conflicting findings among self-reported mental health experiences versus EPDS survey findings. Although 63.4% of survey respondents reported symptoms associated with depression, few women identified their mental health as an area of concern in the interviews. Findings may reinforce the stigma previously found regarding mental health discussions in rural communities. Additional research is needed to understand how to support postpartum mental health while recognizing women may not accurately identify their own symptoms of concern.

### 34 *Pelvic Health Knowledge Among Postpartum Women in Rural Communities: A Mixed Methods Investigation*

**Adriana Oh<sup>1</sup>**, and Kailey Snyder, PhD<sup>2</sup>

<sup>1</sup>Department of Exercise Science and Pre-Health Professions; <sup>2</sup>Department of Physical Therapy, Creighton University, Omaha, NE

**Background:** Pelvic floor disorders are pervasive among cisgender women after childbirth. Few women seek treatment for pelvic health until severe dysfunction has occurred and this is due, in part, to low levels of pelvic health knowledge. The geographic and access barriers to healthcare that are known to impact rural communities may be exacerbating these low knowledge levels however rural communities remain understudied.

**Purpose:** How do scores on a standardized pelvic knowledge instrument (PIKQ) relate to perceptions of pelvic health knowledge among postpartum women in rural communities?

**Methods:** This study employed a sequential explanatory design in which quantitative data (e.g., surveys) were conducted followed by qualitative data (e.g., interviews). For the survey component, a group of 341 rural postpartum women completed the Prolapse and Incontinence Knowledge Questionnaire (PIKQ). Survey findings were analyzed via standard scoring protocol. The survey was followed by 30 semi-structured interviews. Data were analyzed via a deductive content analysis.

**Results:** PIKQ findings suggest 53.4% of women have low knowledge proficiency while 42.5% were categorized as “some proficiency” and 4.1% were categorized as knowledge proficient. Qualitative findings revealed, women reported limited understanding of terms such as Kegel, Urinary Incontinence or Pelvic Organ Prolapse. Women reported a desire for more knowledge and open discussions with their healthcare providers about pelvic health, especially in the postpartum period.

**Conclusion:** Pelvic floor dysfunction remains an underdiscussed and under-supported area of healthcare. Women in rural communities appear to lack knowledge and understanding of their pelvic health that is critical to effectively self-manage their pelvic health and seek treatment when warranted. More work is needed to reduce the consequences associated with untreated pelvic floor dysfunction.

### 35 *A Sociohistorical Review of Alcoholism Perceptions in the U.S.*

**David Law**

Department of History, Creighton University, Omaha, NE

Substance-abuse is one of the most stigmatized disabilities in the world, yet conversations around the topic fall short of the seriousness and in-depth analysis it requires. By examining available literature on alcoholism, I have synthesized a timeline of the sociohistorical progression of the perception of alcoholism in the U.S. since the 1800s. In the early 19<sup>th</sup> century, religious perceptions, particularly those of Catholic and Protestant groups, began to turn against the consumption of alcohol as an ethical concern in their congregations and the United States. Women’s movements engaged in this topic as well, acting as an early example of the gradually increasing influence of female voices in public discourse. Pushes for prohibition continued what temperance movements had started, eventually leading to the passage of the 18<sup>th</sup> Amendment of the U.S. Constitution, though it ended up repealed due to crumbling enforcement. After this tumultuous legal period, alcoholism entered into the field of psychiatry in the 20<sup>th</sup> century, gaining the label of a diagnosis in the first and subsequent iterations of the DSM. Around the same time, Alcoholics Anonymous began under religious rhetoric with the goal of mitigating the damage of alcohol abuse rather than condemning its users as its religious predecessors had done. These latter two ideas persisted into today’s modern medicalization of alcoholism as a disease in today’s scientific literature. However, despite contemporary research, alcoholism, and by extension, addiction, is still one of the most stigmatized disabilities in the world. The purpose of this review is to provide a comprehensive outline of how alcohol consumption and dependence has been viewed, acted upon, and treated throughout American history leading up to today, with the hope of starting conversations to publicly acknowledge alcoholism and substance abuse as a disability, rather than a vice.

**Acknowledgement:** Dr. Andrew Hogan

### 36 *Self-Enhancement and Authenticity: A Unidirectional or Bidirectional Relationship?*

**Gabby O’Connor,** T. Callahan, M. Fyan, and A. Szatmary

Department of Psychology, Creighton University, Omaha, NE

A foundational conceptualization of authenticity (Kernis & Goldman, 2006) argues that living life authentically involves the alignment of four psychological tendencies, including having *awareness* of one’s strengths and weaknesses, and engaging in *unbiased processing* of self-relevant information. While data have been marshaled to support this framework, the *awareness* and *unbiased processing* components stand at odds with a robust literature on self-enhancement which suggests people are habitually *biased* in their processing of self-relevant information (Alicke & Sedikides, 2011). Recent research in our lab has challenged this conceptualization, and in two studies we have demonstrated that higher state authenticity and trait authenticity are associated with biased, not unbiased self-processing. The present study aimed to test whether the relationship between self-enhancement and authenticity is unidirectional, or if the relationship is bi-directional (i.e., if heightened authenticity promotes self-enhancement as well).

167 Participants were randomly assigned to reflect, for one minute, on a time they behaved in a way that made them feel authentic and true to themselves, or, on a time they behaved in a way that made them feel

inauthentic, or untrue to themselves. Participants then spent 5 minutes describing their experience in detail. Following this authenticity manipulation, participants completed a state version of a common self-enhancement measure: the *How I See Myself* questionnaire, in which participants were asked to evaluate themselves relative to a peer on 22 positive and negative characteristics on a 7-point Likert Scale. Results revealed that the positivity of participants' self-evaluations did not differ between authenticity conditions,  $t(165) = -1.29$ ,  $p = .20$ . Both Authentic ( $M = 4.43$ ) and Inauthentic ( $M = 4.55$ ) participants exhibited better-than-average beliefs (compared to scale midpoint, 4;  $p's < .001$ ), but the degree of bias exhibited did not differ between conditions.

These findings suggest that the relationship between authenticity and self-enhancement may be unidirectional, not bidirectional: satisfying self-enhancement concerns promotes authenticity, but eliciting authenticity may not elicit further self-enhancement. These findings are important for future research aimed at better understanding the relationship between self-enhancement, authenticity, and psychological well-being.

**POSTER PRESENTATIONS: 1:30-3:30 PM  
TUESDAY APRIL 19, 2022  
STUDENT ABSTRACTS**

**1    *Patterns of Fluctuating Asymmetry in the Limbs of Terrestrial and Freshwater Turtles***

Gabriel Rivera, Cally Neely, and Alyzza Vitug

Department of Biology, Creighton University, Omaha, NE

An active topic within biology is concerned with the origins and evolutionary diversification of organismal phenotypes. Within this scope, our study focuses on biological pressures that influence patterns of symmetry within the body. In animals that use four limbs for locomotion, one set of limbs (forelimbs or hindlimbs) is generally more important. We hypothesize that limbs with greater functional importance should be more symmetrical than limbs of lesser importance. We used fluctuating asymmetry (FA), defined as non-directional variations between the left and right sides in symmetric structures, to examine differences in limb bones (humeri and femora). Specifically, the aim of this study was to examine the patterns of FA present in the limb bones of turtles in the family Emydidae. Emydid turtles of the subfamily Deirochelyinae are highly aquatic and employ a hindlimb-dominant swimming style, suggesting that hindlimbs should display lower levels of FA. In contrast, emydid turtles of the subfamily Emydinae possess more terrestrial tendencies that place equal importance on the fore- and hindlimbs, suggesting that forelimbs and hindlimbs should display similar levels of FA. My study compared one aquatic species (*Pseudemys rubriventris*) and one terrestrial species (*Terrapene ornata*). In addition, these data were added to a larger data set (from Rivera and Neely, 2020) to gain a more comprehensive understanding of the evolutionary patterns of limb asymmetry in turtles. The results of this study provide important information on the evolutionary stressors that create and maintain biomechanically efficient morphologies.

**2    *Halophiles as Bioindicators for Road Salt Exposure, Part 5***

Grace Heithold, Danielle Hotalling, Daniel Wood, and Keelan Terrell

Department of Biology, Creighton University, Omaha, NE

Halophiles are salt-tolerant bacteria and archaea that can be used as bioindicators for road salt exposure. We quantified the density and identity of halophilic microbes in soil samples collected in southeast Nebraska. Site locations included continuous salt-exposed sites, seasonal salt exposed roadways, unexposed sites, and potentially exposed sites considered more ecologically sensitive. Density of microbes was determined by a modified spot test on halophilic media. The identity of halophilic bacteria was performed by polymerase chain reaction (PCR) of the 16S rDNA of isolated halophilic colonies, followed by Sanger sequencing of the PCR products. The results of this project may shed light on the impact of road salt on soil microbial communities and could impact salt use decisions near waterways and other ecologically sensitive ecosystems.

**3    *Halophiles as Bioindicators for Road Salt Exposure, Part 4***

Ben Engle, Michael Allen, Alex Perez-Chavez, Katie Pilakowski, and Eric Nguyen

Department of Biology, Creighton University, Omaha, NE

Halophiles are salt-tolerant bacteria and archaea that can be used as bioindicators for road salt exposure. We quantified the density and identity of halophilic microbes in soil samples collected in southeast Nebraska. Site locations included continuous salt-exposed sites, seasonal salt exposed roadways, unexposed sites, and potentially exposed sites considered more ecologically sensitive. Density of microbes was determined by a modified spot test on halophilic media. The identity of halophilic bacteria was performed by polymerase chain reaction (PCR) of the 16S rDNA of isolated halophilic colonies, followed by Sanger sequencing of the PCR products. The results of this project may shed light on the impact of road salt on soil microbial communities and could impact salt use decisions near waterways and other ecologically sensitive ecosystems.

#### 4 *Elucidating the Influence of Exportin 6 on the Phenotype of Cutaneous Squamous Cell Carcinoma Driven by 14-3-3ε*

**Moynul Islam**, James A. Grunkemeyer, and Laura A. Hansen

Department of Biomedical Sciences, Creighton University School of Medicine, Omaha, NE

**Background:** Cutaneous squamous cell carcinoma (cSCC) is an increasing threat with around 1.8 million cases diagnosed each year in the US. cSCC has a 4-6% rate of metastasis, with poor prognosis. Surgical excision is the primary treatment available for cSCC. So, identifying non-surgical treatments is an urgent need. Our lab has documented 14-3-3ε protein mis-localization in cSCC, leading to aberrant suppression of apoptotic cell death. 14-3-3ε deletion in the skin reduces skin tumor development and progression in a mouse model. Downregulation of Exportin 6 restores normal 14-3-3ε localization. These data suggest that Exportin 6 and 14-3-3ε may be important targets for the treatment of skin cancer.

**Significance of Problem:** Elucidating the molecular relationship between Exportin 6 and 14-3-3ε in cSCC formation could identify novel strategies for treatment. Mis-localization of proteins such as 14-3-3ε is a unique feature of cSCC relative to normal skin. Therefore, therapeutics targeting this feature are likely to have minimal side effects.

**Hypothesis:** We hypothesize that loss of 14-3-3ε and Exportin 6 will reduce proliferation and trigger apoptosis in cSCC cells.

**Experimental Design and Methods:** In SCC13 cells, we generated 10 CRISPR KO clones for both XPO6 and YWHAE as well as five control (unedited) clones. Genomic DNA from clonal populations was sequenced to identify the nature of CRISPR-mediated mutations. Clonal cell lysates were immunoblotted for Exportin 6 and 14-3-3ε to confirm loss of expression. Cell proliferation and apoptotic cell death were evaluated in the mutant and control cell clones.

**Results:** Sequencing revealed frameshifting in/del mutations at each locus. Immunoblotting confirmed loss of Exportin 6 and 14-3-3ε proteins consistent with the sequencing data. Cell proliferation and apoptosis assays were performed on XPO6 and YWHAE KO clones.

**Conclusions:** The XPO6 and YWHAE KO clones established here will be valuable for further studies defining the relationship between Exportin 6 and 14-3-3ε and their roles in cSCC, potentially leading to the development of novel treatment strategies.

## 5 *Competition of Flower Isoform FWE3 in Cutaneous Squamous Cell Carcinoma Cells*

**Rachel E. Johnson**, Justin C. Rudd, and Laura A. Hansen

Department of Biomedical Sciences, Creighton University, Omaha, NE

**Background:** Cutaneous squamous cell carcinoma (cSCC) is the second most common cancer in humans and affects more than 5 million patients a year in the United States. Cell competition is a process through which sub-optimal cells or wild-type cells are eliminated by more-fit or “super-fit” cells. A protein called Flower (FWE) is involved in cell competition in several cancers. Previous cell competition experiments in human breast and colon cancer cell lines have shown that the human hFWE4 is a “winner” isoform, and hFWE3 is a “loser” isoform. Preliminary data from our lab suggest that the opposite may be true in human skin cancer. The current project was designed to investigate the role of hFWE3 in human cSCC in a cell competition assay.

**Significance of Problem:** Understanding the role of hFWE isoforms and if hFWE mediated cell competition happens in human cSCC could lead to new treatment options. We hypothesized that overexpression of hFWE3 in cSCC cells would produce super-fit cells that outcompete unaltered cSCC cells. **Results/Data:** cSCC cells showed decreased attachment capabilities and were outcompeted after 10 days in coculture with hFWE3 overexpressing cells. RNA-seq analysis on hFWE3 overexpressing cells revealed upregulation of the expression of secreted factors that affect cell attachment. Conditioned media from hFWE3 overexpressing cSCC cells reduced the attachment capabilities and clonogenicity of cSCC cells. **Conclusions:** hFWE3 overexpressing cells outcompete neighboring cells in coculture and upregulate expression of S100 and MMPs, which are known to affect cell attachment. Secretion of these factors into media may cause cells to detach and “lose” in cocultures. These data suggest that hFWE3 is a winning isoform in cSCC cells.

## 6 *Optimization of Peptide Inhibitors of 14-3-3 $\epsilon$ Interactions with CDC25A*

**Seraphine Kamayirese**, Sibaprasad Maity, Laura A. Hansen, and Sándor Lovas

Department of Biomedical Sciences, School of Medicine, Creighton University, Omaha, NE

Squamous cell carcinoma (SCC) is the second most frequent type of nonmelanoma skin cancer. Cytoplasmic mislocalization and overexpression of CDC25A in SCC is associated with resistance to apoptosis. This anti-apoptotic activity of CDC25A is reliant on its interaction with the 14-3-3 $\epsilon$  protein, that binds CDC25A either around the phospho-Ser178 or the phospho-Thr507 residues. Previously, we designed two novel peptides, pS and pT, corresponding to the binding regions of CDC25A to 14-3-3 $\epsilon$  that induce cell death of SCC cells. Here, we systematically modified pS and pT to improve their binding affinity for 14-3-3 $\epsilon$ , thus, promoting apoptosis in SCC.

pS and pT were truncated either at N- or C- terminus to generate their nonapeptide analogs, pS(174–182) and pT(502–510), respectively. Based on preferential binding motifs of 14-3-3 $\epsilon$ , proposed by Li and colleagues, and our computational Ala-scanning, the pS(174–182) and pT(502–510) were modified at different positions. All peptide analogs were N- and C- terminally acetylated and amidated, respectively. To determine binding energies of the peptides, steered molecular dynamics and umbrella sampling (US) simulations were carried out. Computational results were confirmed by differential scanning fluorimetry (DSF), and surface plasmon resonance (SPR).

Analysis of US trajectories showed that all peptide analogs bound to 14-3-3 $\epsilon$  with negative free energy of binding ( $\Delta G$ ). DSF results showed that, complexes of 14-3-3 $\epsilon$  with the pS(174–182) or with some of its analogs had higher melting temperature ( $T_m$ ) compared to 14-3-3 $\epsilon$ -pS complex. Likewise, complexes of 14-3-3 $\epsilon$  with the pT(502–510) or some of its analogs had higher  $T_m$  than 14-3-3 $\epsilon$ -pT complex. SPR measurements showed that, the pT analogs had  $K_d$  of 49–282 nM and pS analogs had  $K_d$  of 0.380–6.563 mM. The designed peptides will be tested for their interference of SCC cell growth to forward the development of novel anticancer agents.

## 7 *Synthesis and Crystal Structures of Novel Lanthanide Phosphites Utilizing Organic Templating Cations*

**Katie Huisman** and Eric M Villa

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Phosphorous acid ( $\text{H}_3\text{PO}_3$ ) is a water-soluble acid and reducing agent. In solution, it easily deprotonates to become phosphite ( $\text{HPO}_3^{2-}$ ) which will bind to metals. With structural similarities to phosphate, a hydrogen atom has now replaced one of the oxygen atoms bonded to the central phosphorus. Phosphites are used as plant fertilizers and can double as a fungicide and pesticide against various pathogens. Its presence within soil matter allows for potential complexation to various metal ions, which greatly influences its stability and mobility within the environment. To better understand the ways metals and phosphites interact, here we investigate reactions between lanthanides and phosphorus acid. Lanthanide phosphite compounds have been synthesized both hydrothermally and using phosphite fluxes. Recently, we expanded this chemistry by exploring solvothermal syntheses. We further those studies here and discuss new lanthanide phosphite structure-types that were synthesized solvothermally and employ 1,10-phenanthroline as an organic templating agent to open up the network. The phenanthroline is protonated in-situ by phosphorus acid forming the phenanthrolium cation featured in these compounds. These new structure-types are unique from the usual dense, three-dimensional lanthanide phosphites, as the organic cation limits their dimensionality. Herein, we present the syntheses and structures in this novel system.

## 8 *Evaluation of GlcN6P Analogs for Glms Ribozyme Self Cleavage*

**Michelle Marie Helmeke, and Ansley Atkinson**

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Antibiotic resistance has created a need for alternative ways of fighting bacterial pathogens. Riboswitches are a class of noncoding RNA elements present in prokaryotes that directly bind to cellular metabolites and modulate gene expression. Many riboswitches provide a mechanism of feedback regulation for gene products within the biosynthetic pathway of the cognate metabolite. Due to their presence in many prokaryotic species, targeting of riboswitches may be an alternative way to combat bacterial pathogens such as *E. coli* and *C. diff*. The glms riboswitch, which is also a ribozyme, serves as a point of control for synthesis of the small molecule, glucosamine-6-phosphate (GlcN6P), which is an integral part of the bacterial cell wall. GlcN6P is the natural ligand for the glms riboswitch/ribozyme and it triggers self-cleavage of the glmS RNA which inactivates the mRNA. The goal of this project is to find potential analogs of GlcN6P that trigger this same self-cleavage activity in *S. aureus* and *B. cereus* using a fluorescence resonance energy transfer (FRET) assay. A FRET assay is a high throughput way of screening numerous analogs of GlcN6P for self-cleaving ability, and ultimately as potential antibiotics.

## 9 *Structural Analysis of OAZ RNA in Agaricus Bisporus*

**Hunter Weitzel**

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Riboswitches are segments of non-coding messenger RNA that are capable of binding to metabolites in cells to manipulate downstream gene expression. Once a riboswitch binds to a metabolite, it undergoes a conformational change and directly acts as a regulatory element for gene expression. This is achieved through termination of transcription or translation, thus suppressing gene expression. Although most of the discovered riboswitches have been found in bacteria, there are riboswitches found in other domains of life. Namely, Dr. Soukup's lab has been investigating a highly conserved riboswitch found in mammals called RNA Ornithine Decarboxylase Antizyme Pseudoknot (OAZ-PK RNA), which is a necessity for polyamine synthesis. Polyamines are organic compounds made up of more than two amino groups that will interact with negatively charged molecules, such as DNA and RNA, to help regulate cellular processes including cell growth, proliferation, and differentiation. As a result, further research on riboswitch interactions with polyamines could open new therapeutics with a greater understanding of disease processes at a molecular level. The presence and function of riboswitches help provide more evidence to the RNA world hypothesis as these pieces of RNA can regulate cellular actions without the aid of enzymes or chemical modifications. Thus, further research is required to understand how these function from an evolutionary perspective and how they function as a regulator. Dr. Soukup's lab has recognized OAZ-PK in mice and investigated conformational changes due to polyamines along with affinities to several other polyamines. The goal of my research is to analyze the interaction of OAZ-PK in mushroom by using methods such as in-line probing and isothermal titration calorimetry, both of which have been used in Dr. Soukup's lab before. This will further our understanding of the importance of riboswitch interactions with polyamines in mushrooms, and thus the RNA world as a whole.

## 10 *Engineering Bacterial Transcription Factors to Bind New Ligand*

**Mia N. Morrissey**, and Benjamin M. Brandsen, PhD

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Genetically encoded biosensors convert the concentration of an intracellular metabolite into an observable genetic response, such as an increase in fluorescence or change in cellular growth rate. Biosensors are useful for optimizing the activity of biosynthetic pathways, allowing large-scale mutagenesis and selection on metabolic pathways to optimize production of key chemical compounds. One rich source of biosensors is naturally occurring allosteric transcription factors, which bind to their ligand and regulate expression of downstream genes. Identification of biosensors for new ligands is challenging, however, especially when a naturally occurring allosteric transcription factor is not already known. Here we report our efforts to engineer the allosteric transcription factor BenM to respond to the ligands 3-hydroxybutyric acid and 3-hydroxyvaleric acid, key components of polyhydroxyalkanoate polymers. We generated a library of benM variants using error-prone PCR, optimized conditions for positive and negative selection of BenM, and performed multiple rounds of selection to enrich this library with BenM variants that respond to target ligands. Our efforts demonstrate a straightforward strategy to rapidly engineer biosensors that respond to new ligands.

## 11 *Synthesis of Phenylspinacine Derivatives in Effort to Create New Hypertension Drug Compounds*

**Jackson Parks**, and Martin Hulce

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

In the current state over 25% of the population in the world suffers from hypertension. Uncontrolled hypertension can lead to a plethora of illnesses including, but not limited to: congestive heart failure, chronic kidney disease, strokes, and heart attacks. Control of hypertension as of late has sought lots of research attention where new drugs are constantly being developed, whether they be ACE inhibitors, diuretics, beta blockers, and calcium channel blockers (are commonly prescribed). These drugs have implored the use of hundreds of compounds, including that of imidazole derivatives. To this point, our goal was to synthesize a phenylspinacine molecule, an imidazole derivative, in route to investigating the hypertensive properties. The project started out by using a Pictet-Spengler reaction to convert histidine into 4-phenyl-L-spinacine. Though, hydrogenolysis would not occur without a protecting group. We initially investigated protected 4-phenyl-L-spinacine para-toluenesulfonyl chloride, which was unable to hydrogenolyze. Next, esterification of 4-phenyl-L-spinacine was studied as a means for more complete hydrogenolysis using para-toluenesulfonyl chloride and tert-butyldimethylsilyl chloride as protecting groups. Hydrogenolysis did not occur for either compound. Finally, using the phenylspinacine methyl ester compound a 2-(Trimethylsilyl)ethoxymethyl acetal (SEM) group was attached. We are currently investigating the hydrogenolysis ability of this compound.

## 12 *Impact of Radiotherapy and Chemotherapy on Neuronal Cells*

**Destiny Jordan**, Yohan Walters, Anne Hubbard, and Andrew Ekpenyong

Departments of Biology, Chemistry, and Physics, Creighton University, Omaha, NE

Neuroblastoma is the most common malignant tumor in children. By the time of diagnosis, the cancer has often metastasized to other areas of the body, such as lymph nodes, bones, bone marrow, liver, and skin. Common treatments for neuroblastoma include chemotherapy and radiotherapy, which are given to neutralize the cancerous cells. As these treatments target the cancer cells but not their metastasis, the inadvertent prometastatic effects of these treatments are beginning to emerge. These inadvertent effects are the foci of this study. Here, we use an Electric Cell-substrate Impedance Sensing (ECIS) device to measure the migration (metastasis) and growth of SH-SY5Y and PC-12 cells, cancerous and non-cancerous neuronal cells respectively. Previously, we employed microfluidic microcirculation mimetic (MMM) devices to examine the effects of chemotherapy on metastasis. We discovered that leukemic cancer cells treated with doxorubicin and daunorubicin displayed enhanced retention in the microcirculation, a key step in the metastatic cascade, and enhanced migration following chemotherapy. Bearing in mind that over 90% of all cancer deaths are caused by metastasis, this display of pro-metastatic effects after chemotherapeutic treatment highlights the urgent need for anti-metastasis therapy, as both chemo- and radiotherapy target the proliferation of cancer. This work has the potential to be a substantial contribution to the new research frontier called Physics of Cancer, which focuses on the mechanical properties of cancer cells and their role in cancer progression and metastasis.

## 13 *Binding Studies of the Interaction Between PCNA and CAF-1*

**Neal Sinha** and Lynne Dieckman

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

DNA in the nucleus gets packaged into chromatin, which is comprised of nucleosomes. Each nucleosome consists of DNA wrapped around a complex of eight histone proteins. Replication-coupled nucleosome assembly is the process by which newly synthesized DNA gets packaged to form nucleosomes immediately after replication. This process determines whether DNA is accessible to transcription factors, which is crucial for gene silencing and gene activation. Replication-coupled nucleosome assembly involves two major proteins. Proliferating cell nuclear antigen (PCNA) is a ring-shaped protein that encircles DNA and recruits the other major protein, chromatin assembly factor 1 (CAF-1), to the replication fork. CAF-1 is a heterotrimeric protein that carries histones to the newly replicated DNA. The direct interaction between PCNA and CAF-1 is required for proper gene silencing, however, this interaction has not been characterized. The goal of my project is to use protein-protein binding assays to determine which regions of CAF-1 facilitate its interaction

with PCNA. Thus far, binding assays show an interaction between PCNA and a region of CAF-1 not previously known to bind to PCNA. This suggests a unique mechanism of interaction between PCNA and CAF-1 and provides valuable insight for further research on how this interaction regulates nucleosome assembly.

## 14 Occurrence of *Candida Auris* Infection at Creighton School of Dentistry

**Paul McCaslin<sup>1\*</sup>**, Luke Klaus<sup>1\*</sup>, Shikha Tarang<sup>2#</sup>, Frank S. Sleder<sup>2</sup>, and Michael D. Weston<sup>2</sup>

<sup>1</sup>College of Arts and Sciences, Creighton University, Omaha, NE; <sup>2</sup>School of Dentistry, Creighton University, Omaha, NE; \*Co-first authors; #Current Affiliation - American Red Cross, Dedham, MA

**Introduction:** While *Candida* overgrowth can be visually diagnosed in the oral cavity, species-specific molecular identification of *Candida* is essential to identify multi-drug resistant (MDR) species, which are associated with high mortality. Although *Candida albicans* (*C. albicans*) is one the most common species, several studies suggest an increase in the incidence of oral candidiasis (OC) due to non-*C. albicans* *Candida* (NCAC). One species, in particular, *C. auris*, is a significant NCAC and a newly emerging MDR species. The *C. auris* pathogen is considered a "superbug" by the Centers for Disease Control (CDC) and thus poses a serious global health threat. In addition to person-to-person contact, *C. auris* is also transmitted through contact with contaminated surfaces, increasing its pathogenicity. Dental healthcare settings can play a significant role in early identification, limiting *C. auris* community spread and preventing disease outbreaks. Dentists' accessibility to the oral cavity enables early detection and treatment before *C. auris* invades throughout the body, which can be life-threatening. This study assessed oral *Candida* prevalence, including *C. auris*, in dental patients treated at the Creighton School of Dentistry (CUSoD).

**Methods:** IRB and IBC approval was obtained to carry out the studies. Saliva samples were collected from May 2021 through January 2022, concentrated, and used to inoculate SAB low and high salt selective media containing gentamycin/streptomycin and grown for at least 48 hours at 30°C. Purified DNA from positive cultures was isolated, and PCR was employed to determine the prevalence of oral *Candida* using yeast clade universal primers to ribosomal DNA ITS1-5.8S-ITS2. Quantitative real-time PCR was also used to identify *C. auris* specific ITS2 ribosomal DNA present in positive growth culture DNA. *C. auris* DNA (Sudha Chaturvedi, University of Albany) and *C. albicans* (ATCC 10231) were used as positive controls for PCR and culturing/DNA extraction, respectively.

**Results:** Of the 152 patient saliva samples collected and cultured, 49% (74/152) demonstrated saturated turbidity at 48 hours in low salt SAB. In high-salt SAB incubations, which is selective for a much smaller subset of yeast species including *C. auris*, 21% (32/152) produced only mild/moderate visual turbidity. Yeast clade and *C. auris* specific DNA PCR amplifications were negative for *C. auris* in high salt cultures (0/24), although varied PCR product sizes detected through agarose gel electrophoresis point to a diversity of yeast species in the human oral cavity, including *C. albicans*, *C. guilliermondii* and *C. glabrata*. DNA sequencing of PCR products will be necessary to identify the gentamycin/streptomycin-resistant strains.

**Conclusions:** 50% of the saliva samples analyzed showed evidence of OC. Nevertheless, none of those samples were positive for *C. auris*. Given the high incidence of OC along with a high prevalence of underlying risk factors (e.g., recent hospitalization, compromised immune system, poor diet, stress, chronic diseases) in the patient population seen at the CUSoD, it is worthwhile to continue assessing the prevalence of antibiotic-resistant *Candida* sp. represented in longitudinally collected samples from volunteer patients.

**15** *The Effects of Locally and Commercially Sourced Honey on Vero Cell Culture Wound Healing*

**Nathan Jobalia**, Lydia Roudabush, Hannah Reynolds, and Riley Hartman

Center for Undergraduate Research and Scholarship

Honey has been a well-known treatment for various medical ailments, especially wounds, for over 8000 years. With the rise of modern medicine, the use of honey as a medical treatment has decreased from times past. However, with recent medical developments viewing medicinal honey to be a viable treatment for wounds, honey has come into the spotlight once again. This study aims to test twenty honeys, ten local and ten store bought samples, and their effects on in-vitro Vero cells previously damaged by a predetermined scratch. This experiment intends to use a wound-healing assay and microscope photography to calculate the rate at which the wound closes in order to determine which types of honey heal the damaged cells faster. The study hopes to identify the types of honey best used for wound healing. As a result of this experiment, the study intends to contribute greater knowledge and awareness to honey's wound healing properties, which can be added as another viable treatment for patients with wounds that have difficulty healing. Such research will also promote awareness of the issues adulteration of honey has in the healing of wounds.

**16** *The Validity of Different Methods for Estimating Body Composition in Patients with Osteogenesis Imperfecta*

**Ally Thavenet**, Sydney Fogarty, Mackenzie Kilton, Jackie Kay, and Joan Eckerson

Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE

**Purpose:** Osteogenesis imperfecta (OI) is a bone disorder characterized by frequent fractures, bone deformities, short stature, and scoliosis. Physical function is limited depending upon the severity of OI type (I – IV) and may contribute to obesity and associated comorbidities. Therefore, the ability of healthcare professionals to accurately estimate body composition is important to guide decisions regarding diet, exercise, and long-term health in this population. The purpose of this study is to compare the validity of percent fat (%BF) estimates from skinfolds (SF) and bioelectrical impedance analysis (BIA) to values obtained by air displacement plethysmography (ADP) in patients with OI.

**Methods:** Participants will complete a general health questionnaire and informed consent prior to testing. Criterion %BF will be assessed using the BOD POD®, which measures body mass (BM) using a precise scale and body volume (BV) via ADP to determine body density (BM/BV) that is then converted to %BF using the Siri equation. SF measurements will be obtained at the chest, mid-axilla, triceps, abdomen, suprailiac, subscapular, medial calf, and thigh using a Lange caliper and included in age-specific equations to estimate %BF. BIA sends a low-level electrical current through the body and the resistance measurement is used in equations to estimate %BF.

**Results:** Data collection is in progress at Children's Hospital. Validity of %BF estimates will be based upon the mean difference between predicted (SF, BIA) and actual (ADP) %BF values, r value, SEE, and the similarity between standard deviations of predicted and actual %BF values.

**Conclusion/Significance:** We hypothesize that patients with less severe OI (Type I and Type IV) will present with lower levels of fat mass and %BF and higher levels of fat-free mass compared to Type III OI, and that BIA and SF estimates of %BF will be comparable to those obtained with ADP in patients with Type I and IV OI.

## 17 *Myogenic Regulatory Factors in Hibernating Ground Squirrels*

**Elizabeth Kettler<sup>1</sup>, Nik Johnson<sup>1</sup>**, Eric Bredahl<sup>1</sup>, David Law<sup>1</sup>, Megan Dalicandro<sup>1</sup>, Jake Siedlik<sup>1</sup>, Joan Eckerson<sup>1</sup>, Mitch Magrini<sup>1</sup>, Kristen Drescher<sup>2</sup>, Frazer Heinis<sup>3</sup>, and Matt Andrews<sup>3</sup>

<sup>1</sup>Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE;

<sup>2</sup>Department of Medical Microbiology and Immunology, Creighton University, Omaha, NE; <sup>3</sup>School of Natural Resources

Hibernating animals can preserve muscle tissue during prolonged periods of disuse and inactivity. Understanding myogenic regulation during hibernation may identify future drug targets for chronic muscle wasting or attenuate muscle loss during periods of prolonged microgravity exposure. Purpose: To identify the myogenic regulatory mechanisms responsible skeletal muscle preservation in hibernating ground squirrels (*Ictidomys tridecemlineatus*) vs. non-hibernating rats (*Rattus norvegicus*). Methods: Ground squirrels were kept in a 5°C room free of lighting. Following anesthesia with isoflurane, the extensor digitorum longus and soleus were collected from hibernators and non-hibernators. Protein analysis was performed for myostatin and myoblast determination protein 1 (MyoD), as well as markers of oxidative damage and naturally occurring antioxidants. All experiments were performed in triplicate. Results: Between the hibernator and the non-hibernator, there were significant differences in the degree of oxidative damage, as measured by 4-hydroxynonenal expression ( $p < 0.05$ ). Myo-D, but not myostatin, was significantly elevated in the hibernator vs. the non-hibernator ( $p < 0.05$ ). Although not significant, there was a trend towards higher glutathione peroxidase expression in the hibernator. Conclusion: Our data suggests that the upregulation of MyoD likely plays a role in muscle preservation of hibernating ground squirrels.

## 18 *Determination of Lysine Acetylation Susceptibility of DksA and its Effects on Global Metabolism in B. Burgdorferi*

**Armond J. Isaak**, William K. Boyle, Hannah S. Sorensen, Amanda K. Zalud, Amanda K., and Travis J. Bourret

Department of Medical Microbiology & Immunology, Creighton University, Omaha, NE

For successful completion of its infectious cycle, the Lyme disease spirochete *Borrelia burgdorferi* must overcome a wide range of environmental stresses. *B. burgdorferi* harbors limited repertoire of gene regulatory proteins and the molecular mechanisms underlying their ability to direct transcriptomic responses in response to changes in environment remain enigmatic. Recently, we described the global role for the DnaK suppressor protein (DksA) in the regulation of *B. burgdorferi* gene expression in response to nutrient limitation. In a previously published study, a multitude of *B. burgdorferi* proteins, were identified as targets of lysine acetylation by endogenously produced acetyl-phosphate (Ac-PO<sub>4</sub>) during in vitro growth. Lysine acetylation is a reversible post-translational modification (PTM) that contributes to the regulation of virulence gene expression in a variety of bacterial pathogens. In silico analysis of *B. burgdorferi* DksA suggests that five lysines (L118, L119, L121, L122, and L124) located in the C-terminus of DksA are likely targets for acetylation. In this study, I determined the susceptibility of recombinant DksA to lysine acetylation and will characterize the impact of this PTM on the gene regulatory activity of DksA required for *B. burgdorferi* to complete its infectious cycle in ticks and mice. Additionally, our previous work suggested DksA may contribute to lysine acetylation through its regulation of *ackA*, a gene that encodes an enzyme that produces Ac-PO<sub>4</sub>. Currently, I am comparing the profiles of acetylated proteins in wild-type and *dksA*-deficient *B. burgdorferi* strains to the contribution of DksA to lysine acetylation.

## 19 *Effect of Residue Substitutions on the Surface Electrostatics of Normal Prion Protein (PrP<sup>C</sup>) and Prion Protein Fibrils*

**Alyssa Thallemer<sup>1</sup>, Linh Bui<sup>2</sup>**, and Patricia Soto<sup>2</sup>

<sup>1</sup>Department of Pharmacology and Neuroscience, Creighton University, Omaha, NE; <sup>2</sup>Department of Physics, Creighton University, Omaha, NE

Transmissible spongiform encephalopathies (TSEs), prion diseases, arise when normal prion protein conformers (PrP<sup>C</sup>) misfold into PrP<sup>Sc</sup> aggregates which accumulate in the brain. Prion proteins are normally GPI-anchored to the surface of the cell membrane. Although both animals and humans are susceptible to these fatal neurodegenerative disorders, certain species have greater resistance to TSEs despite the amino acid sequences of PrP<sup>C</sup> being at least 85% identical. Evidence indicates that at a low pH PrP<sup>C</sup> tends to aggregate more easily; colocalization with negatively charged cofactors also impacts the formation of aggregates by speeding up the misfolding process. Our overarching goal is to assess the effect of electrostatics on driving the initial misfolding of the prion protein along with determining interactions between the protein aggregate and plasma membrane. We use continuum electrostatics to calculate the electrostatic potential of PrP<sup>C</sup> and of recently proposed cryo-EM structures of prion protein fibrils. To assess differences between varying orientations of protein fibrils within cell plasma membranes, we calculated the free energy of several distinct fibril morphologies. We also examined the effect of unique residue substitutions on the surface electrostatics of dog PrP<sup>C</sup>, human PrP<sup>C</sup>, and mouse PrP<sup>C</sup>. Our results indicate that unique residue substitutions in dog PrP<sup>C</sup> change the surrounding polarity of the surface electrostatics when compared to human PrP<sup>C</sup>. Unlike humans, dogs are a highly resistant species to the development of transmissible spongiform encephalopathies. We will show our analysis of the effect of different pH values on the surface electrostatics of PrP<sup>C</sup> from species highly resistant and highly susceptible to prion diseases. Lastly, we will discuss how electrostatics could drive possible insertion modes of protein aggregates in the membrane and how each of these scenarios could represent an anti-prion druggable pathway.

## 20 *Tris-Triazolebenzene Compounds*

**Joseph Newton**

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Expanded aromatic molecules are interesting because of their uses in solar cells, fluorescent properties used in organic LEDs, and consumer products such as paints. The goal of this project is to use a combination of click chemistry and Pd-catalyzed annulation to prepare annulated 1,3,5-tris-triazolebenzene compounds. These “pinwheel” like compounds will be compared to non-annulated and mono-annulated analogs in order to study whether the aromaticity of the target compounds is extended among arene ring components or localized. The identity and location of periphery functional groups will be studied to determine their impact on the properties of the compound. All molecules will be analyzed by NMR and Mass Spectrometry, and to the extent possible X-Ray diffraction in order to define their structural properties. Electronic properties will be studied by UV-Visible absorbance and fluorescence spectroscopy. Results of the synthesis and characterization will be presented.

## 21 *TREM1 Signaling Mechanisms and Their Role in Global Ischemia-Induced Neurodegeneration*

**Rachael Urquhart**, Hyunha Kim, Gopal P. Jadhav, and Jee-Yeon Hwang

Department of Pharmacology and Neuroscience, Creighton University, Omaha, NE

Global ischemic stroke elicits selective, delayed neurodegeneration of hippocampal CA1 pyramidal neurons, causing memory deficits associated with stroke. Identifying mechanisms underlying global ischemia is necessary for stroke therapy advancements. Preliminary RNA-seq and Ingenuity Pathway Analysis identified differentially expressed genes in ischemic rat CA1 related to signaling via neuroinflammatory pathways and the triggering receptor expressed on myeloid cells-1 (TREM1). TREM1 is a pivotal innate immune receptor that initiates and amplifies inflammation via synergism with immune response-related Toll-like receptors. TREM1 has an established proinflammatory role in myocardial ischemia, sepsis, and focal ischemia, but its role in global ischemia remains unclear. We hypothesize TREM1-mediated neuroinflammation promotes global ischemia-induced neurodegeneration, and TREM1 inhibition will rescue hippocampal integrity. RT-qPCR and Western blot analyses of rat CA1 reveal that TREM1 protein expression is significantly elevated 3HR following ischemia insult, and this increase is maintained at 48HR. Additionally, TREM1 signaling partners (DAP12, SYK, phosphor-SYK), signal transduction targets (Nf-kB, STAT3, phospho-STAT3), and cytokines (IL-1B, IL-18, IL-6) show altered protein expression within 3-48HR of ischemic insult. Next, to determine whether activation of TREM1 signaling is causally related to global ischemia, we examined the ability of LR12, a TREM1 inhibitory peptide, to prevent ischemia-induced neuronal death. We are currently collecting data from this experiment. If LR12 prevents TREM1 signaling and rescues neurons against global ischemic insult, these findings establish the role of TREM1-mediated neuroinflammation in global ischemia pathology and identify TREM1 as a potential therapeutic target.

## 22 *Shedding of the Prion Protein from the Nasal Cavity of Naturally Infected Animals*

**Benjamin Folz**, and Anthony E. Kincaid

Department of Pharmacy Sciences, School of Pharmacy and Health Professions, Creighton University, Omaha, NE

Chronic wasting disease (CWD), a highly-transmissible prion disease affecting deer, elk and moose, is endemic in north America having been detected in 28 states and 3 provinces. The incubation period for CWD is 18-24 months during which time infected animals can shed prions in feces, urine and blood. The shedding of prions into the environment is of great concern as prions are known to persist in the environment for years during which time they could spread the disease to other animals. Recently there was a report of prions being detected in the nasal cavity and shed in mucus collected from the nasal cavity of infected animals. These cases involved animals that had been experimentally inoculated in the brain, an unnatural route of infection. The purpose of this study was to determine if prions could be detected in the nasal cavity of animals that had been infected by a natural route, following inhalation into the nasal cavity. Brains and nasal cavities were collected from hamsters that had inhaled prion-infected, or mock-infected, brain homogenate into their nasal cavity at two-week intervals beginning 6 weeks after inoculation. Decalcified nasal cavities and brains were embedded in paraffin, sectioned on a microtome at 7  $\mu$ m and immunohistochemically processed for the presence of the misfolded prion protein. Prions were not detected in the olfactory bulb or olfactory mucosa of the animals until two weeks prior to the onset of clinical signs, at the very end of the incubation period (>90%). These results suggest that naturally infected animals are not actively shedding prions in their mucus for long periods of time (months to years), instead the potential for the shedding of prions in their nasal mucus is restricted to a matter of weeks, if it occurs.

**23** *Search by Lackadaisical Quantum Walk with Symmetry Breaking*

**Jacob Rapoza**, and Dr. Thomas Wong

Department of Physics, Creighton University, Omaha, NE

"The lackadaisical quantum walk is a lazy version of a discrete-time, coined quantum walk, where each vertex has a weighted self-loop that permits the walker to stay put. They have been used to speed up spatial search on a variety of graphs, including periodic lattices, strongly regular graphs, Johnson graphs, and the hypercube. In these prior works, the weights of the self-loops preserved the symmetries of the graphs. In our research, we show that the self-loops can break all the symmetries of vertex-transitive graphs while providing the same computational speedups. Only the weight of the self-loop at the marked vertex matters, and the remaining self-loop weights can be chosen randomly, as long as they are small compared to the degree of the graph." – (Rapoza & Wong, 2021)

**24** *Microfluidic Microcirculation Mimetic for Targeting Metastasis in Cancer Treatments*

**Arij Khan**, Kylie Machida, and Andrew E. Ekpenyong

Department of Physics, Creighton University, Omaha, NE

Metastasis, or the process in which cancer cells spread from the initial tumor to other organs and tissues of the body is the leading cause of cell death in cancer patients. As shown in previous studies by the Translational Biomedical Physics (TBP) Lab, when cells are treated with anti-cancer drugs such as Doxorubicin and Danorubicin, cell stiffness is increased before eventual cell death. This stiffness can lead to increased extravasation of the cancer cells, a factor contributing to cell metastasis. In the TBP Lab, we investigate the role of cell mechanical properties in cancer metastasis. My role in the TBP so far is the use of replica molding to produce the Microfluidic Microcirculation Mimetic (MMM) device which mimics the pulmonary microcirculation (a part of blood circulation) and enables the measurement of cell mechanical properties via transit times, thereby unraveling the role of such properties in cancer metastasis. Steps in the development and production of this device will be presented.

**25** *Computational Modelling of Impedance Based Cell Migration for Radiotherapy Against Brain Metastasis*

**Bayode Ibironke**, Melanie Schwengler, Katherine Lemke, and Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

**The Problem:** Cell migration is a major component of malignant tumor progression, especially to the brain. About one-third of patients with another type of cancer will develop one or multiple metastatic brain tumors. The most common origins of brain metastasis are systemic cancer of the lung, breast, skin, or GI tract. In the Translational Biomedical Physics Lab, several nanoparticle-mediated strategies have been developed to improve treatment outcomes for radioresistant cancers of the brain such as glioblastoma. Here, we begin applying those strategies to cancers that have metastasized to the brain.

**Experimental and Computational Methods:** Having recently used a commercially available Electric Cell Impedance Sensor (ECIS) to quantify the migration of various cancer cell lines following chemotherapy and following radiotherapy (using a cell irradiator, Fixation), we have applied equivalent circuits and power-law equations to model the complex impedance data, using MATLAB codes. Additionally, R codes were used to model with three different curve fit algorithms: smoothing spline, logistic model, and segmented regression. My role in this project is to adapt the R codes for modelling ECIS results obtained in the case of cancers that metastasize to the brain.

**Preliminary Results:** Previous results from using MATLAB codes on glioblastoma cells capture the increased migration of irradiated cells prior to cell death. Recently published R codes written for ECIS data appear more robust in fitting experimental data and may also succeed in providing biophysically relevant insights into metastasis. Preliminary results using our adjusted R codes will be presented.

## 26 *Microgravity as a Tool for 3D Tissue Engineering and Space Medicine*

**Conner Peeples**, Adam Taylor, Spencer McKinley, and Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

Microgravity is a condition of apparent weightlessness which can be simulated in a laboratory setting. Astronauts returning for space missions suffer bone, muscular and immune system dysfunctions partly due to microgravity. Interestingly, efforts to find solutions to these adverse effects of microgravity led to the discovery of beneficial effects such as the transformation of single cells in culture to 3D tissue. In this project we use simulated microgravity to develop 3D tissue models useful for biomedical science and engineering applications. We grow brain cancer cells lines (T98G and U87) in microgravity simulated using a NASA-developed Rotary Cell Culture System (RCCS), which transforms the cells into tissue-like spheroids. The 3D tissues are then used for further biomedical research including the physics of cancer.

## 27 *Computational Modelling of Impedance Based Cell Migration for Improved Chemo- and Radiotherapy*

**Melanie Schwengler**, Katherine Lemke, Bayode Ibironke, and Dr Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

**Background:** Computational Modelling includes the use of computers to study complex systems using mathematics, physics, and computer science. This research attempts to study the metastasis of cancer cells with computational modeling. Metastasis itself is the complex process by which cancer cells spread from the primary tumor to other tissues and organs of the body where they form new tumors. It leads to over 90% of all cancer deaths. A crucial step in the metastatic cascade is migration. Various chemotherapeutic and radiotherapeutic approaches target cancer cell proliferation and not metastasis. We have recently quantified the impact of these approaches on cancer cell migration, using bioimpedance as a readout. Here, we present mathematical models and computational fits, using MATLAB and R respectively, for experimental data which provides mechanistic insights into the role of various chemotherapeutic and radiotherapeutic approaches on cancer metastasis.

**Methods:** Having recently used a commercially available Electric Cell Impedance Sensor (ECIS) to quantify the migration of various cancer cell lines following chemotherapy and following radiotherapy (using a cell irradiator, Fixation), we applied equivalent circuits and power-law equations to model the complex impedance data, using MATLAB codes. Additionally, R codes were used to model with three different curve fit algorithms: smoothing spline, logistic model, and segmented regression.

**Results:** Without data fitting, we find that the irradiated T98G cells (Glioblastoma, brain cancer cells) attach and migrate significantly more than non-irradiated cells in the first 20 hours post irradiation. Fits of equivalent circuit models and power-law models quantify and characterize the raw impedance data for brain cancer cells. MATLAB codes capture the increased migration of irradiated cells prior to cell death.

**Conclusions:** In MATLAB, the model parameters such as the power-law exponent capture the increased migration of irradiated cells prior to cell death. In the future, R codes may also succeed in providing robust and biophysically relevant insights into metastasis which, in turn, can potentially inform urgently needed anti-metastasis strategies in cancer treatments.

**28** *Computational Models for Impedance-Based Cell Migration using MATLAB and R Codes*

**Katherine Lemke**, Bayode Ibironke, Melanie Schwengler, and Dr Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

Cell migration is a key process in the development and maintenance of multicellular organisms. Among methods for in vitro measurement of cell migration is the use of an electric impedance sensing device (ECIS). The modeling of electric cell-substrate impedance sensing (ECIS) data has been growing in popularity in order to better understand cancer metastasis and other diseases in which aberrant cell migration is implicated. Typically, the impedance is graphed in relationship to time, and there are many models used to fit these data. The best fitting models seem to be the power law and growth models, but other tested models include the Standard Linear Liquid model, the Kelvin Voight model, and the Burger model. Furthermore, there are many software programs that can be used to model these data, to create graphs of fittings and other visual representations to help better understand the experimental data. In this study, we use codes in R and MATLAB to determine which provided visuals that were easier to interpret so that the obtained ECIS data could be used most effectively. We compare the results of R and MATLAB models for ECIS data of cells in the context of cancer metastasis following chemotherapy and radiotherapy. This will hopefully offer biophysical insights and rationale for anti-metastasis strategies and better treatment outcomes.

**29** *Hydroxyurea is Antiproliferative Against Chronic Myeloid Leukemia but may Promote Metastasis*

**Nicholas Herrero**, Sukhman Viridi, Israel Bryant, and Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

The Translational Biomedical Physics (TBP) lab on campus recently showed that Doxorubicin and Daunorubicin, commonly used anticancer drugs, increase cell stiffness before causing cell death, predisposing the cells to clogging and extravasation, the latter being a step in metastasis. Several lines of compelling pre-clinical and clinical evidence by other groups following our findings have reported that well known anticancer drugs that are effective against the primary tumor also induce reactive responses supportive of dissemination of cancer cells. In search of mechanisms behind this adverse effect of chemotherapy, we are focusing on cell mechanical properties as possible macroscopic signatures or readouts of molecular level effects. The specific focus of this project is on myelogenous (K562) leukemic cancer cells treated with the drug Hydroxyurea (HU), an inhibitor of deoxynucleotide synthesis approved by FDA for the treatment of chronic myelogenous leukemia (CML), squamous cell carcinoma of the head and neck, etc. HU is widely used against CML. We then readout the mechanical properties of HU-treated and non-treated cells using the microfluidic microcirculation mimetic (MMM) device, which mimics aspects of blood circulation (pulmonary microcirculation) and enables the measurement of cell mechanical properties via transit times through the device. Our results will hopefully clarify whether HU induces changes that might be conducive to their metastasis in addition to its ability to facilitate cell senescence. Such clarification will provide rationale for new anti-metastasis drugs.

### *NAD(P)H Phasor-FLIM Imaging Indicates Metabolic Differences Between Cancerous Tissue and Healthy Tissue*

**Samuel J. Rogers**, George Varghese, Michael G. Nichols, Tyler B. Farr, Hayden M. Hubbs, Connor J. Kalhorn, Cecilia Myers, Alicia C. Nguyen, Daniel R. Snyder, Thien Q. Tran, Daniel H. Wood, Dan L. Pham, and Laura A. Hansen

Department of Physics, Creighton University, Omaha, NE

As cancerous tissue develops, it becomes more metabolically aggressive than healthy tissue. Cancerous tissue shows increased proliferation and therefore demands greater energy production. Our research uses NAD(P)H phasor-Fluorescence Lifetime Imaging Microscopy (FLIM) imaging to detect metabolic changes in vivo that are characteristic of skin cancer. The goal is to develop a non-invasive optical biopsy as an alternative for punch biopsies – the current standard diagnostic tool. We utilized NAD(P)H phasor-FLIM imaging to observe differences in NAD(P)H fluorescence intensity and NAD(P)H bound fraction between UVA treated and sham treated SKH1 mice. We also measured collagen within the epidermis and dermis with FLIM and second harmonic generation. Measuring collagen allows us to assess architectural shifts that are indicative of tumorigenesis. During our longitudinal study, we correlated changes in non-invasive measurements of metabolism with visual observations of UVA-induced papillomas. These observations were then verified with standard histological and immunofluorescence imaging. Our data suggests UVA treated SKH1 mice show a decrease in NAD(P)H bound fraction. Ultimately, our methods suggest a potential alternative to the punch biopsy – a non-invasive biopsy with the use of phasor-FLIM.

**Acknowledgments:** This research was made possible by grants from the National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH), and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

### *Fluorescence Guided Morphometry in Nanoparticle-Mediated Radiotherapy*

**Erika Jank**, Yohan Walter, Anne Hubbard, Olivia Salas, Allie Benoit, and Dr. Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

Glioblastoma Multiforme is a very aggressive form of brain cancer, affecting more than 10,000 people in the United State every year. The mean survival rate is approximately one year after diagnosis. The goal of this research is to address this intimidating outlook for glioblastoma patients by discovering new treatment options that are more effective in targeting and destroying cancerous tissue. Traditionally, the most common treatment options include surgery, radiation, and chemotherapy. This study examines the utilization of nanoparticles during the radiation process. Clinically relevant doses were delivered to conditions with and without the treatment of carbon quantum dots. To analyze the results, fluorescence images were obtained, using both Hoechst and Calcein dyes. The images were closely examined using the ImageJ software. The effect on cells treated with radiotherapy alone was compared to the effect on those treated with nanoparticle-mediated radiotherapy. Our preliminary results suggest that the use of carbon quantum dots in conjugation with radiotherapy decreases the mitotic cell ratio.

### 32 *Antinociceptive Effects of Morphine:Ketamine Mixtures in Rats*

**Matthew Meyer,** Eva D'Epagnier, John Rogers, Conor Strumberger, and Vanessa Minervini

Department of Psychological Science, Creighton University, Omaha, NE

Chronic pain is a serious public health concern. Prescription opioids (are the “gold standard” for treating moderate to severe pain despite their well-documented adverse effects (dependence, respiratory depression, constipation). There is a need for safer, more effective treatments for pain. One strategy for improving the margin of safety of opioids is combining them with other analgesic drugs to decrease the opioid dose needed for pain relief, thereby avoiding adverse effects that occur with larger doses. The NMDA receptor antagonist ketamine has been used safely and effectively to treat pain, but only under a narrow range of conditions (in emergency departments, post-operative recovery, and combat casualty). The current studies used a model of acute pain (warm water tail withdrawal) to determine the antinociceptive effects of morphine and ketamine alone and in mixtures (in 3:1, 1:1, and 1:3 ratios) in 7 male Sprague Dawley rats. Given alone, both morphine (1-10 mg/kg) and ketamine (3.2-32 mg/kg) dose-dependently increased tail withdrawal latency, with morphine having greater potency and efficacy as compared to ketamine. In mixtures, the potency of morphine or ketamine to produce antinociception was enhanced by 2 fold as compared to either drug given alone. Dose-additivity analyses showed that the effects of morphine:ketamine mixtures were additive. Furthermore, morphine:ketamine mixtures that relieved pain also were tested in an assay of constipation in a separate group of 8 rats. While both morphine alone and ketamine alone dose-dependently decreased fecal output, morphine:ketamine mixtures did not enhance constipation. Therefore, morphine:ketamine mixtures appear to selectively enhance antinociception. It remains unknown whether morphine:ketamine mixtures have other adverse effects (abuse, physical dependence, respiratory depression). Morphine:ketamine mixtures might have greater therapeutic potential than mu opioids alone for treating moderate to severe pain, but only if adverse effects of each drug are not enhanced.

**Acknowledgments:** Center for Undergraduate Research and Scholarship as well as the Department of Psychological Science at Creighton University

### 33 *Does Vaped Delta-8-Tetrahydrocannabinol Have Abuse Liability?*

**J.M. King,** C.M. Shinnars, K.W. Kalkman, A.A. Mollison, G. Bacchin, M.D. Eckrich, D.J. Durbin, H.A. Fitzgerald, A.B. Bhinder, A.R. Dolatta, L. Beringer, and D.J. Stairs

Department of Psychological Science, Creighton University, Omaha, NE

Delta-8-Tetrahydrocannabinol (Delta-8) has the largest growth in sales in the 2021 cannabinoid market, although overall sales still trail cannabidiol (CBD). Despite some states moving to make Delta-8 illegal there is little to no research investigating the behavioral effects of Delta-8. The current study was designed to develop a rat model of vaped Delta-8 and CBD to better understand if these drugs have abuse liability, both individually and in combination using a conditioned place preference procedure (CPP). Thirty-five male Sprague Dawley (PND 56) rats were exposed for either 5 or 10 min to vapor containing various doses of Delta-8 distillate (10 or 20 mg/300 ml) or Delta-8 mixed with CBD isolate (CBD/Delta-8; 30/10 mg/300 ml) dissolved in propylene glycol (PG), prior to being placed into a CPP apparatus. Using a biased three-chamber CPP design, animals first had a 15 min pretest with access to all three chambers in order to determine their initial side preference. On the next day, the animals started daily conditioning trials where they received a vape exposure session with either drug or PG only. Following vape session, animals were immediately confined to one of the pairing chambers of the CPP apparatus for a 30 min conditioning trial. Conditioning trials were repeated across either 8 or 16 days, in order for the rats to have four or eight alternating PG and drug conditioning sessions. Following 8 and 16 conditioning trials, the animals were tested for CPP during a 15 min test session where the animals again had access to all three chambers. Results showed Delta-8 at 10 mg/300 ml tended to result in rewarding effects depending on chamber side but 20 mg/300 ml resulted in aversive effects. When a mixture of CBD/Delta-8 was used significant rewarding effects were found. The current results indicated that Delta-8 THC can have rewarding effects, but this is dose dependent and when mixed with CBD may heighten the rewarding effects. Future studies will look at other doses of these cannabinoids and if these effects are consistent in female rats.

### 34 *The Effect of a 4-Week Power- Vs Strength-Focused Resistance Exercise on the Load-Velocity Curve, Movement Speed, and Maximal Strength in Older Adults*

**Mae Grahek,** Kelley G. Hammond, Leland Barker, Mikayla Grocki, Blake Murphy, Jacob A. Siedlik, and Mitchel A. Magrini

Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE

**Purpose:** The purpose of this study was to examine the effect of an individualized power- vs. strength-focused lower body resistance training (RT) program on concentric movement speed, muscle strength, and the associated load-velocity curve in older adults (OA).

**Methods:** Twelve OA volunteered to complete a 4-week resistance training program and were randomly split into a power-focused (PG; n=6; Age=74±9 y) and a strength-focused RT group (SG; n=6; Age=75±6 y). Concentric velocity ranges were determined by each participant's pre-testing load-velocity profile. Load was adjusted to ensure movement speed was within appropriate ranges. Movement speed for each training and testing repetition was assessed using a linear position transducer during the concentric phase of the squat. All testing and training were done with a belt squat machine. The SG and PG lifted at a mean velocity of 0.25-0.3 m/s and within ±0.15 m/s of their mean velocity at peak power, respectively. Participants were provided biofeedback of their movement speed and encouraged to move the load as quickly as possible. Maximal strength was assessed before (PRE) and after (POST) the exercise intervention by increasing the load lifted by 20% increments of the participant's body weight until they reached their one repetition maximum (1RM). Maximal movement speed (MMS) was determined as the highest mean velocity achieved when only lifting the empty rack. The load reported was the total system mass (participants' body weight and the load lifted). The load-velocity (LV) slope was determined by examining the mean velocity that participants moved each incremental load. A linear regression equation was developed using the mean velocity and load at each incremental step. The LV slope and y-intercept were selected as dependent variables, in addition to 1RM and MMS. Separate 2 (condition) × 2 (time) repeated measures ANOVAs were run to examine any potential differences between groups in MMS, 1RM, LV slope, and y-intercept. Independent samples t-tests were run to investigate differences between groups in work completed, age, height, and weight. Hedges' g effect size was used to estimate effect size.

**Results:** No Condition × Time interaction for LV slope (p = 0.354), LV intercept (p=0.879), MMS (p=0.181), or 1RM (p=0.130) were revealed. However, there were significant main effects for time in LV slope (p=0.030, g=7.19; Pre: -273.2±29.9 Load/m/s vs. Post: -417.1±45.3 Load/m/s), MMS (p=0.020; g=-3.53, Pre: 0.7±0.1 m/s vs. Post: 0.8±0.1 m/s), 1RM (p≤0.001; g=-1.95; Pre:148.8±47.6 lbs vs Post: 203.4±64.4 lbs), but not in LV intercept (p=0.08, g=-3.10, Pre: 309.3±61.2 vs. Post: 424.9±87.4). Finally, no significant differences in total work completed (p=0.605; PG: 133,331.7±4,522.02 Rep/Load vs. SG: 148,457.0±10,652.6 Rep/load), age (p=0.855), height (p=0.285; PG: 168.2±5.3 cm vs SG: 163.17±7.9 cm), and weight (p=0.190; PG: 71.9±11.1 kg vs SG: 66.9±7.9 kg) between groups.

**Conclusions:** These data suggest, when work is matched, both training modes increased LV slope, MMS, 1RM in OA. Therefore, both power- and strength-focused resistance exercise improved muscle strength and movement speed within a 4-week timeframe in OA.

**Practical Applications:** Practitioners and strength and conditioning professionals can use these data to guide training prescription for their older adult clientele.

## 35 *Evaluation of Pharmacist-Led Intervention to Improve Access to Glucagon Emergency Devices*

Jenna Schwartz, Pharm.D. Candidate 2023; Emily Knezevich, Pharm.D., BCPS, CDCES, FCCP; Megan Sotebeer, Pharm.D. Candidate 2024; **Cami Bizal**, Pharm.D. Candidate 2023; and Wandy Marquez Moyeno, Pharm.D. Candidate 2023

Department of Pharmacy Practice, School of Pharmacy and Health Professions, Creighton University, Omaha, NE

**Background/Objective(s):** A major limiting side effect for attaining tight glycemic control in patients with type 1 and type 2 diabetes mellitus is hypoglycemia, especially in association with the use of rapid acting insulin. The 2021 American Diabetes Association Standards of Care recommend glucagon administration as the preferred method to reverse hypoglycemia. Recent analysis of co-prescribed glucagon emergency device with rapid acting insulin amongst this CHI clinic's providers demonstrated an opportunity to improve patient access to glucagon. The objective of this study is to provide patients identified with type 1 and type 2 diabetes receiving rapid acting insulin prescribed by CHI Dundee prescribers with glucagon devices if they have not previously been prescribed. Further, this study seeks to define primary adherence rate of the prescribed glucagon product and evaluate factors such as insurance coverage, prescriber specialty, age, gender, and ethnicity to determine if they impact adherence to the prescribed drug.

**Methods:** This study uses a retrospective chart and prescription fill review of patients at CHI Health Dundee Clinic who are diagnosed with type 1 or type 2 diabetes mellitus and have a prescription for rapid acting insulin. Of these patients, those without a co-prescribed glucagon product will be included in the intervention. A single letter will be sent out to inform them of the need for glucagon, along with a written prescription for a glucagon product and educational information on when to use glucagon and how to administer the medication with the product device preferred by their insurance. Offers will be made within the letter sent to have clinic pharmacist available to provide education beyond what is received at medication dispensing, if needed. Four weeks after sending the glucagon prescription electronically to the pharmacy, the research team will utilize the Nebraska PDMP, or phone follow ups to pharmacies of non-Nebraska patients to evaluate fill rates for glucagon products. If products are not picked up, the research team will identify the barrier for nonadherence and attempt to address. The research team will then keep a record of fill rate after intervention to address barriers to nonadherence.

**Results:** Pending Project Completion

**Implications/Conclusions:** Findings will help identify relevant interventions for pharmacists in the prevention and treatment of hypoglycemia in patients with type 1 or type 2 diabetes receiving rapid acting insulin. Understanding barriers to adherence and acquisition of glucagon can help pharmacists to better help patients obtain these crucial life-saving products.

**36** *Aethiopians in the Roman World: Deconstructing a Whitewashed Mediterranean*

**Ashleigh Furey**, and Erin Averett

Department of Fine and Performing Arts, Creighton University, Omaha, NE

The modern construct of race and the systemic prejudice that is inherently associated with it is a social and political issue that requires our utmost attention around the globe. Particularly in America, the re-education of this topic is vital to mollifying ignorance, shifting prejudiced attitudes, and fostering progress in our society through unity. A crucial area of study to collectively reevaluate is the Classics, as it has long been both entrenched in the discipline and used as a tool by others to “whitewash” past cultures, thus serving as a tool in white supremacist propaganda. Ancient Roman history has been manipulated over time in support of white supremacist ideals by glossing over the rich diversity that existed throughout the empire, and by championing Roman culture as the most revered model of Western society. My research intends to recolor the true demographic of the Roman Empire, particularly focusing on the Kushite culture referred to as “Aethiopians” at the southern border of the empire. Furthermore, I will elucidate how Romans perceived race and ethnicity through analyzing their depictions of Aethiopians in ancient art and literature. A particular focus will be given to artistic representations from the Italic peninsula during the high period of the Roman Empire from 27 BCE to 305 CE. Through examining these artifacts, I have been able to conclude that there is little evidence to suggest there was systemic prejudice based solely on skin color in the Roman Empire that resembles the virulent racism of the modern day. Nevertheless, it may be argued that Roman speculations on the influence of heredity and climate on behavior in other cultures displayed the germination of racial thinking which was later advanced by imperialists from the 18th century to the 20th century.

**37** *The Art of Mother Nature*

**Amanda Edwards**

Department of Fine and Performing Arts, Creighton University, Omaha, NE

The Age of Connection research project aims to build relationships in Creighton University’s communities through a hands-on collaborative mural. The Creative Occupations Club has been approved to add a mural on Creighton University’s campus located next to the Boyne building. Under my art direction and guidance, this mural will foster new relationships with the members of Creighton University as well as local populations. This mural has the potential to inspire creativity, understanding of different perspectives, teamwork, and knowledge sharing. Although I will be both the lead artist and art director, I will gain so much supplemental knowledge about occupational therapy from the OT students and incorporate those ideas into the project design. Their all-encompassing healthcare awareness can become an inspiration and an advantageous learning experience to my artistic process. This collaboration will allow me to learn from them and encourage their understanding of a major artistic endeavor from concept sketch through to the final unveiling of the mural.

**38** *Satisfaction with Democracy in Latin America: The Effects of Rising Chinese Power*

**Eliana Rodriguez**

Department of Political Science and International Relations, Creighton University, Omaha, NE

After a long period of authoritarian rule throughout the twentieth century, Latin America has been experiencing an era of uninterrupted democracy. At present, satisfaction with democracy has been in gradual decline, reaching its lowest level in 2018. This study considers factors that influence satisfaction with democracy in Latin America over the 2000-2020 period. Specifically, this study focuses on the effect that Chinese economic influence has on satisfaction with democracy in Latin America. I find ambiguous support for my hypothesis.

## *Furthering the Link Between a Desire to Dissociate and Negative Reinforcement Patterns of Drinking*

**Grace O. Putz,** Emma R. Hickman, Michaela J. Cordova, Kailey A. Richner, Dennis E. McChargue, and Alicia K. (Klanecky) Earl

Department of Psychological Science, Creighton University, Omaha, NE

**Statement of Problem:** In the absence of significant dissociative tendencies, the desire to dissociate has been conceptualized as a mechanism that facilitates alcohol use to reduce negative experiences in college samples. A desire to dissociate can be reliably measured using the Desire to Dissociate Scale (DDS; Klanecky Earl et al., 2020), a modified version of the Dissociative Experiences Scale (DES-II; Carlson & Putnam, 1993), and is associated with alcohol, trauma, and emotion regulation variables (e.g., Klanecky et al., 2012). Current aims seek to replicate and extend correlates identified in Klanecky Earl et al. (2020) between the DDS and variables measuring alcohol use and negative experiences, as well as better understand in individuals' own words why they wish to dissociate.

**Method:** College students (N=954) across two Midwestern universities completed an online survey battery. Following endorsement of a DDS item, participants were asked to describe "why" they would like that experience.

**Results:** Replicating Klanecky Earl et al. (2020), DDS scores were positively correlated with drinking to cope, alcohol consequences, trauma-related variables, and emotion regulation difficulties ( $r$ 's=.12-.43;  $p$ 's<.02). Extending previous findings, DDS scores were positively correlated with current stress, anxiety, and depression; increased negative affect and experiential avoidance ( $r$ 's=.31-.40); and reduced positive affect ( $r$ =-.20; all  $p$ 's<.01). Preliminary results ( $n$ =485) describing why students desire to dissociate have been analyzed thematically (Braun & Clarke, 2006) for the three most endorsed DDS items. The two recurring themes across questions described either wanting to escape one's experience or absorb in another experience. For example, nearly 73% of participants wished to not hear all or part of what was said when talking with someone. Most (44.3%) identified that this was to avoid aspects of the conversation, whereas 14.3% desired to engage more in internal experiences (e.g., one's thoughts). Additionally, 62.2% of participants wished to be able to ignore pain. While 51.5% described how the removal or escape from pain would be beneficial, 21.4% described being in the pain as a negative experience. The description of being in or absorbed by the pain was correlated with increased alcohol consumption and consequences, and trauma symptoms ( $r$ 's=-.15 to -.23;  $p$ 's<.04).

**Conclusion:** Findings are consistent with theoretical facets of absorption and escape in dissociation (Butler, 2006), and replicate and extend previous work on the DDS. Those who cannot escape or dissociate from negative experiences (e.g., pain) may be more vulnerable to problem drinking for negatively reinforcing effects.

**40** *Who Needs the Goddess? The Psychological Implications of God as Male vs. Female in an Experimental Setting*

**Sofia Deatherage**, Shreshtha Ray, and Jill Brown, PhD

Department of Psychological Science, Creighton University, Omaha, NE

Culture shapes our psychological realities. In pre-history, as foragers transitioned to agriculture, gender norms and attitudes changed and the road for patriarchal societies was paved (Boserup, 1970). While the exact mechanisms are numerous, religion was an important influence in constituting beliefs and enforcing patriarchal rules (Ruether, 2005), specifically the androcentric nature of the god concept in Western societies. While many individuals' characterization of God as masculine has been remarked upon by feminist writers (Daly, 1979; Goldenberg, 1979; Ruether, 1979), and documented empirically (Foster & Keating, 1992), feminist theologians hypothesized that the culture's male god-concept is detrimental to women in several ways. For example, the male god-concept can have an impact on general status of women in relation to men. To better understand what might have been lost by the extraction of the female goddess, the current study looks at ethnographic evidence of matriarchal and female centered societies and experimentally questions what psychological differences exist when people are presented with the female god concept. Participants consisted of 94 undergraduates recruited using the Creighton Sona system, assigning them passages to read or write about a god or goddess and switching the pronouns to see how their levels of self-efficacy and empowerment differed as a result. Results revealed strong main effects for gender on almost all outcome variables with males presenting higher on all measures. The only exception was the Sense of Power Scale where women felt more power in relationship to a significant male in their life. An interaction between male-female god concept condition and participant's gender on self-efficacy revealed males scored significantly higher on self-efficacy than females. Additionally, Neosexism was significantly predicted by conservative political affiliation rating, identifying as male, and lower power to influence males.

**41** *Gender and the Corporate Elite*

**Molly Kleist**

Department of Psychological Science, Creighton University, Omaha, NE

This study describes the gender composition of the corporate elite in 2017 and their ties to the energy policy-planning network. Women have traditionally been excluded from the corporate elite, making up only 15.5% of the corporate elite in 2013. However, women have also been more likely to serve on multiple boards in the network when compared to men. Past research ignoring gender indicates that serving on multiple boards and having a central network location is associated with influence or power within the corporate community. Just because women are increasingly represented on boards, however, does not mean they are gaining proportionate power and influence in the corporate community. I examine gender patterns of the Fortune 500 corporate community and the policy-planning network, addressing a gap in research about gender in the PPN and its linkages to the corporate world. My findings indicate an increase of women in the corporate elite, with women now representing 21.88% of individuals in the network. I also find women's average network centrality is significantly higher than men's and despite the increase in the percentage of women within the corporate community, they remain more likely to serve on multiple boards. However, the data also show women are compensated on average at significantly lower levels and are no more likely to interact with the PPN, calling into question whether their greater interlocks and centrality are indicative of greater power and influence.

**ORAL PLATFORM PRESENTATIONS: 9:00-11:00 AM**  
**TUESDAY APRIL 19, 2022**  
**STUDENT ABSTRACTS**

1

9:00 AM  
HARPER  
2045

*Transcriptomic Analysis of Cochlear Outer Hair Cell Heterogeneity in Adult Mice*

**Caroline Pass,** Zhenhang Xu, Shu Tu, Yan Zhang, Huizhan Lui, Yusi Fu, David He, Jian Zuo  
Department of Biomedical Sciences and Lynch Comprehensive Cancer Research Center,  
Creighton University School of Medicine, Omaha, NE

**Background:** Outer Hair Cells (OHCs) are sensory receptor cells in the mammalian cochlear sensory epithelium (SE). OHCs in different regions in the SE vary in their biological properties, ultimately contributing to the sensitivity and frequency selectivity along the cochlea. Previous findings have shown some genes are differentially expressed in OHCs along the SE, but the expression pattern has not been further characterized. The spatial gradient expression pattern in mammals has also been identified and characterized in the avian cochlea through single-cell RNA-sequencing (scRNA-seq). ScRNA-seq has allowed the study of individual cells' transcriptome profile and has proven to be the best way to study the heterogeneity of cell populations. Adult cochlear OHCs have proved difficult to obtain because cells are difficult to maintain once leaving their unique environment in the cochlea, limiting the study of heterogeneous molecular and biological processes at the adult stage. As a result, there are currently no scRNA-seq studies identifying heterogeneity among OHCs of the mammalian cochlea. Our group has successfully performed scRNA-seq and bioinformatic analysis on three different age groups in mammalian cochlear SE cells, allowing for the characterization and understanding of the molecular basis for OHC heterogeneity.

**Significance of Problem:** There is currently no literature on scRNA-seq identifying heterogeneity among OHCs of the adult cochlea. Spatial gradients of gene expression could potentially contribute to the differences in biological processes along the longitudinal axis of the cochlea. Identification of these processes and what controls the differences will allow future studies to experimentally test and understand why there are spatial differences among OHCs in the cochlea. Understanding the implications of a spatial gradient on why high-frequency OHCs are more susceptible for ototoxic insults, such as noise and cisplatin chemotherapy, would ultimately result in therapeutic benefits.

**Hypothesis:** Cochlear OHCs express a spatial gradient among different turns of the mammalian cochlea. The cochlear OHC gradient results in different biological pathways being activated among the different turns. Spatial gene expression and pathway activity are regulated by master regulators.

**Experimental Design:** Basilar membranes were collected and cells were dissociated from postnatal day 14 (P14) and P28 C57BL/6 mice (n=8 & 12) and P70 CBA mice (n=12). All steps for cDNA library were performed following the 10x Genomics protocol. Chromium Next GEM Single Cell 3' Reagents Kit v3.1 was used. Libraries were sequenced on an Illumina Nextseq and raw sequencing counts were processed using CellRanger (v6.0.1). In-depth bioinformatic analysis was conducted on an integrated data set of six scRNA-seq experiments from three time points. Clustering and differential gene expression (DGE) analyses were conducted to uncover heterogeneity among OHCs and trajectory analysis aided in identification of a spatial gradient. A gene ontology (GO) analysis was performed on differentially expressed genes for pathway enrichment identification. Gene regulatory network (GRN) analysis was run to uncover transcription factors (TFs) involved in controlling the spatial gradient. In situ hybridization was performed for validation of bioinformatic findings.

**Results/Data:** P14, P28, and P70 identified 601, 1,086, and 654 OHCs total, respectively. Clustering analysis disclosed seven OHC clusters at each age. Published literature on mammalian cochlear DGE aided in guiding clustering analysis characterization. DGE and trajectory analyses revealed genes uniquely expressed in opposing clusters of the analysis as well as genes expressed in a gradient among the seven clusters. Clusters at each age were classified as apical, middle, and basal regions of the cochlea. In situ validation confirmed the bioinformatic findings and allowed for the confirmation that the clusters represent spatial localization among the turns of the cochlea. GO analysis uncovered enriched pathways within upregulated and downregulated genes among the

different regions of the cochlea. GRN analysis classified potential TFs controlling the identified spatial differences among the OHCs in the cochlea.

**Conclusion:** We have successfully performed scRNA-seq on cochlear OHCs from three different ages of adult mice. Bioinformatic analysis revealed heterogeneity and spatial gradient of OHCs along the longitudinal axis of the mammalian cochlea. Identified OHC heterogeneity contributes to physiological, morphological and pathological properties as well as differential vulnerability of OHCs along the cochlea. In depth understanding of TFs involved in controlling GRN provides a stronger understanding of what controls cochlear OHC heterogeneity.

2

### *Time Up and Go Test and Patient Preferences of Stability of Different Orthosis in Older Adults*

9:15 AM  
HARPER  
2045

**Christian Wilhelm**, Olivia Raspotnik, and Abbis Jaffri

Department of Physical Therapy, Creighton University, Omaha, NE

**Introduction:** There is no gold standard for a balance orthosis that provides the most stability in older adults. Evaluation of Time up and go test (TUG) and patient perceptions of different orthosis may provide clinicians and surgeons with insight into making an evidence-informed decision regarding optimal orthosis following injury or surgery in older adults.

**Methods:** This was a laboratory-based crossover study. 18 subjects (12F:6M, age: 74.6±75.26 yrs, height: 167.85 ± 10.36 cm, mass: 76.76±16.92 kg) participated in this study. Four orthosis conditions were evaluated in all participants: participant's own shoe, tayco brace, moore balance brace, and walking boot. TUG was performed in each orthotic condition in a randomized order to eliminate the order effect. Participants also subjectively rated each orthosis for stability and comfort. Repeated measures ANOVA was used to assess the differences in different orthotic conditions.

**Results:** Walking boot had significantly higher ( $p<0.01$ ) TUG score (10.76±3.40s), as compared to participants own shoes (7.30 ± 0.97s), tayco brace (7.52 ± 1.22) and moore balance brace (7.41 ± 1.18). For participants stability perception, participants found walking boot (1.43 ± 1.53 cm) to be significantly ( $p<0.05$ ) less stable than participants' own shoes (5.82 ± 1.77 cm), tayco brace (5.07 ± 1.82 cm), and moore balance brace (3.92 ± 1.64 cm).

**Conclusion:** The participants performed poorly on TUG score with walking boot as compared to other orthotics. Moreover, participants felt least stable with walking boot followed by moore balance brace, tayco and their own shoes, respectively. The TUG score is a strong predictor for future falls in elderly populations and walking boots may put older adults at risk for falls. Clinicians and surgeons should take this into consideration before providing walking boot to older adults.

3

9:30 AM  
HARPER  
2045

*Analysis of Bacterial Growth in the Presence of glmS Riboswitch Ligand Analogs*

Alexandra Van Cleave, Clare Weber, and Dr. Juliane Soukup

Department of Chemistry, Creighton University, Omaha, NE

Many members of public health systems are becoming increasingly concerned about antibiotic resistance. Antibiotics that have been developed in the past are becoming less effective as bacteria adapt to the stressors that these drugs attempt to induce within them. Recently, researchers have begun investigating the potential of riboswitches as antibacterial drug targets. Riboswitches are sections of non-coding mRNA that effect the expression of downstream genes in response to ligand binding.

The *glmS* riboswitch controls the expression of fructose-6-phosphate amidotransferase which catalyzes the production of glucosamine-6-phosphate (GlcN6P), a precursor in bacterial cell wall synthesis. Importantly, the *glmS* riboswitch is categorized as a catalytic ribozyme due to the fact that it demonstrates self-cleavage upon binding to GlcN6P. This negative feedback degrades the mRNA, inhibiting *glmS* gene expression and preventing synthesis of the cell wall. The *glmS* riboswitch is highly prevalent in bacteria, determined to be in more than 400 strains of gram-positive bacteria and 5 strains of gram-negative bacteria. Due to its prevalence and its ability to control cell viability, the *glmS* riboswitch is a potential target for new antibiotics.

This project aims to identify an analog with similar affinity as GlcN6P for the *glmS* riboswitch to catalyze self-cleavage of the riboswitch to decrease cell viability. Growth assays were performed to monitor the growth of *Bacillus subtilis* and *Staphylococcus aureus* in the presence and absence of potential GlcN6P analogs with the goal of decreasing or eliminating bacterial growth. Current studies suggest that L-serine can decrease bacterial growth at concentrations of near 47 mM for *B. subtilis* and 24 mM for *S. aureus*. Verification of the mechanism of the interaction with the *glmS* riboswitch is being performed using RT-PCR and future studies will investigate the effects of L-Serine on mutant strains of *B. subtilis* and *S. aureus*.

4

9:45 AM  
HARPER  
2045

*"I am more than a 'felon' or 'inmate.": An Exploration of the Self-Worth Indicated by Incarcerated Adults Applying for In Prison Programming*

Nora Martin and Dr. Dawn Irlbeck

Department of Cultural and Social Studies, Creighton University, Omaha, NE

Of the individuals who are currently incarcerated within Nebraska, 95% will reenter society. This makes the work that RISE, a nonprofit located in Nebraska that works to reduce recidivism in the state, of the utmost importance. In partnership with RISE, I examined two research questions: How do individuals who are currently incarcerated and seeking to be a member of the RISE in-prison programming view their self-worth? and At the end of RISE in-prison programming, how do participants indicate their self-worth? To address the first research question, I analyzed application essays of individuals who are currently incarcerated and seeking to be a part of RISE's in-prison programming specifically looking for indications of self-worth. To address the second question, I analyzed reflection essays in order to determine how the participants indicated self-worth at the end of RISE's in-prison programming. Main findings include that in the application essays, individuals indicated either high or low self-worth while in the reflection essays, individuals indicated mostly high self-worth. The results of this research aided RISE in understanding the population they are serving, which became the impetus for RISE curriculum changes.

5

10:00 AM  
HARPER  
2045

*Evaluation of Palliative Care Competency Among Undergraduate Students Following Completion of ELNEC Undergraduate Course*

**Cindy Selig, DNP, RN**, Amanda Kirkpatrick, PhD, RN, Marilee Aufdenkamp, MS, RN, Whitney Van De Graff, MSN, RN

College of Nursing, Creighton University, Omaha, NE

**Background:** The American Association of Colleges of Nursing (AACN) includes care of patients and families during the (EOL) in the Essentials of Baccalaureate Education for Professional Nursing Practice. The ELNEC undergraduate curriculum was created to educate student nurses on use of best practices in EOL and palliative care (PC). The curriculum is theoretical, application-based, and provides case examples and helpful tips that can be used in practice. The case examples are adaptable for the concept-based model which is the framework for the Creighton College of Nursing curriculum.

**Purpose:** To evaluate palliative care competency among students following completion of the end-of-life (EOL) Nursing Education Consortium (ELNEC) undergraduate curriculum.

**Method:** The study is conducted as an evaluation for student competency of palliative care (PC) among the Accelerated and Traditional Nursing Students. The study included two assessments:

1. A pre-assessment of nursing student competency of palliative care near the beginning of their nursing program prior to introduction of the ELNEC modules.
2. A post-assessment of student competency of palliative care after the completion of the ELNEC modules and prior to the end of course simulation of EOL care which is near the end of their senior semester.

**Statistical Analysis:** Quantitative analysis of pre-/post-CARES Competency scores and descriptive analysis of student demographics. Comparison data among groups with correlational analysis were evaluated.

6

10:15 AM  
HARPER  
2045

*Neuromuscular Deficits with Loss of KMT5B*

**Jason Hulén**, R. Wickramasekara, J. Hallgren, P. Abel, and H.A.F. Stessman

Department of Pharmacology and Neuroscience, Creighton University School of Medicine, Omaha, NE

**Background/Research Question:** The histone methyltransferase gene *KMT5B* is a human neurodevelopmental disorder risk gene. Human *KMT5B* variation elicits motor deficits such as hypotonia and developmental delay. *KMT5B* is a chromatin methyltransferase epigenetic regulator. We hypothesize that *Kmt5b* heterozygous mice will exhibit phenotypes similar to those observed in humans with *KMT5B* heterozygous disruptive variation. Furthermore, we hypothesized that these deficits are primarily due to *Kmt5b*'s role in either skeletal muscle or motor nerves.

**Experimental Design:** Mice with a *LacZ* gene-trap cassette inserted into the *Kmt5b* gene (denoted as *HET*) were crossed with wild-type mice (*WT*) to produce litters consisting of *WT* and *HET* offspring. Tissue-specific knockout mice were derived by crossing *Kmt5b* floxed mice with mice expressing either alpha-actin (*ACTA*) or motor neuron and pancreas homeobox 1 (*MX1*) driven Cre recombinase. All litters were subjected to reflex motor tests (surface righting and grasp strength) at postnatal day (P) 10 and P11, respectively. Body weight was measured at numerous points during mouse development.

**Results/Data:** Weight was significantly decreased in male *HET* mice only. For all ages measured between P10 and P43, male *HET* mice had statistically significantly decreased weight ( $p < 0.05$ ). Male *HET* mice had increased time to right ( $p = 0.017$ ) and increased angle at fall in the grasp strength ( $p = 0.047$ ) tests. In stark contrast, female mice and all tissue-specific knockout mice were not statistically significantly different.

**Conclusions:** Our results show that global *Kmt5b* loss exhibit a similar phenotype to those observed in humans with *KMT5B* mutations but only in male mice. Surprisingly, the tissue-specific knockout

models did not replicate the deficits. Therefore, the deficits exhibited in the global loss model are likely caused by *KMT5B* loss outside of the skeletal muscle and/or the motor nerve. In conclusion, our results provide evidence that *Kmt5b* loss mice display a motor development delay and hypotonia phenotype.

7

### *Orexin and Long-Term Potentiation in Kv1.1 KO Mice*

9:00 AM  
HARPER  
2046

**Joseph A. Kostansek IV**, Timothy A. Simeone, and Kristina A. Simeone

Department of Pharmacology and Neuroscience, Creighton University School of Medicine, Omaha, NE

**Background:** The Kv1.1 (KO) mouse is a preclinical model of TLE with cognitive impairment. Orexin neurons project to the hippocampus, which contains orexin receptors (OX1Rs and OX2Rs). Prior literature reveals a bidirectional, concentration-dependent effect of orexin on synaptic plasticity. High concentrations inhibit long-term potentiation (LTP) – a molecular correlate of memory. Preliminary data from *ex vivo* experiments reveal that (i) hippocampi from KO mice have impaired synaptic plasticity at the Schaffer Collateral-CA1 (SC-CA1) synapse. (ii) It has been further shown that applying a dual orexin receptor antagonist (DORA) on KO hippocampal slices improves pre-synaptic plasticity, indicating that orexin exerts a more significant influence on the hippocampal synaptic activity of KO mice when compared to WT littermate controls.

**Hypothesis:** We hypothesized that *ex vivo* DORA application reverses synaptic plasticity impairment in KO mice.

**Experimental Design:** Coronal hippocampal slices from wild-type C3HeB/FeJ mice and Kv1.1 KO mice were placed over a 64-electrode grid while perfused with artificial cerebrospinal fluid (aCSF). I/O curves were used to determine the stimulus that elicits 40-60% of the maximum response at the SC-CA1 pathway. fEPSPs were generated with a paired pulse for 15 minutes to acquire baseline. In control experiments, after 15 minutes, LTP was induced with a theta-burst stimulation at 70% of the maximum response. In treatment conditions, 100nM TCS-1102 (DORA) in aCSF was applied to the slice until stabilization of the fEPSPs. Once stabilized, LTP was induced with a theta-burst stimulation at 70% of the maximum response. Following LTP induction was a 60-minute recording. fEPSP slopes (10-90%) were used to quantify responses. Two-way ANOVA was used to evaluate the data with  $p < 0.05$  considered significant.

**Results:** *Ex vivo* application of 100nM DORA attenuated LTP deficits in KO mice.

**Conclusion(s):** This data establishes a physiological role for orexin in hippocampal synaptic plasticity and that DORA treatment is effective in attenuating *ex vivo* molecular learning and memory deficits. Data from this study will identify an orexin-mediated mechanism to explain epilepsy-associated cognitive dysfunction and provide new targets for future drug development.

*Postural Assessment of Older Adults with a New Ankle Brace Compared to Contemporary Braces*

9:15 AM  
HARPER  
2046

Olivia Raspotnik, Christian Wilhelm, and Abbis Jaffri

Department of Physical Therapy, Creighton University, Omaha, NE

**Introduction:** There is no gold standard for a balance orthosis that provides the most stability in older adults. Evaluation of Center of Pressure (COP) sway with different orthosis conditions may provide clinicians and surgeons with insight into making an evidence-informed decision regarding optimal orthosis following injury or surgery in older adults. The primary objective of this study is to assess the Tayco brace, which is a novel brace that provides stability while also providing motion.

**Methods:** This was a laboratory-based crossover study. 18 subjects (12F;6M, age:  $74.6 \pm 75.26$  yrs, height:  $167.85 \pm 10.36$  cm, mass:  $76.76 \pm 16.92$  kg) participated in this study. Four orthosis conditions were evaluated in all participants: participant's own shoe, Tayco brace, Moore balance brace, and walking boot. Three balance trials were performed in each orthotic condition with bilateral standing. The average of the three trials was taken for the final analysis. Paired t-test was used to assess the differences in different orthotic conditions from the Tayco brace for anteroposterior (AP) and mediolateral (ML) COP sway.

**Results:** There was no significant difference ( $P > 0.05$ ) between Tayco ( $22.5 \pm 9.63$  cm), Moore balance brace ( $23.70 \pm 8.36$  cm) and participant's own shoes ( $24.05 \pm 8.26$  cm) in AP COP excursion. However, there were significant differences ( $P < 0.05$ ) between Tayco and walking boot ( $32.5 \pm 9.73$  cm) in AP excursion. There were no significant differences ( $P > 0.05$ ) between Tayco ( $10.83 \pm 5.15$  cm), walking boot ( $14.28 \pm 7.58$  cm), and participant's own shoes ( $13.20 \pm 5.20$  cm) in ML excursion. However, there was significantly more ML excursion found in the Moore brace condition ( $14.27 \pm 6.25$  cm) when compared to the Tayco brace condition.

**Conclusion:** The Tayco brace provided more overall stability than other orthotic conditions. Clinicians and surgeons should take this into consideration before making decisions about orthotics for older adults.

9

### *Structural and Functional Analysis of Crassostrea gigas OAZ-PK RNA*

9:30 AM

**Rhiannon McCracken**<sup>1</sup>, Spencer Thompson<sup>1</sup>, Siddharth Venkatraman<sup>1</sup>, and Juliane Strauss-Soukup<sup>1,2</sup>

HARPER  
2046

<sup>1</sup>Department of Chemistry and Biochemistry, <sup>2</sup>Department of Medical Microbiology and immunology, Creighton University, Omaha, NE

A riboswitch is a non-coding RNA sequence that regulates the expression of a downstream gene when it is bound to a metabolite. When the riboswitch RNA interacts with a specific metabolite, it undergoes a conformational change, which leads to a change in gene expression. Ultimately, gene expression is altered so as to inhibit the production of this same metabolite within its metabolic pathway. The Soukup lab is currently researching a potential mammalian riboswitch in the Ornithine Decarboxylase Antizyme pseudoknot (OAZ-PK) RNA segment. Previous work in the lab revealed that OAZ-PK RNA in mouse undergoes conformational changes in the presence of a specific polyamine. A polyamine is an organic compound that influences cell growth and differentiation. Since riboswitches have such a profound influence on metabolic pathways in bacteria, this provides an outlet for new antibiotic treatments. Identification of similar noncoding RNAs in eukaryotes will open up possibilities for novel antibiological agents.

My project focuses on studying a potential riboswitch in *Crassostrea gigas*, a species of oyster. More specifically, I am performing In-Line Probing (ILP) experiments to analyze the secondary structural changes of this RNA segment when it interacts with various concentrations of natural and non-natural polyamines. Preliminary data from ILP experiments suggest that the OAZ-PK RNA in oyster is undergoing conformational changes in the presence of different concentrations of spermine. In the future, more ILP experiments will be performed, along with the use of Selective 2'-Hydroxyl Acylation analyzed by Primer Extension (SHAPE) to further study the polyamine concentration-dependent conformational changes in OAZ-PK RNA.

10

### *Design and Synthesis of Short Chain Mycolic Acid Analogs*

9:45 AM

**Thomas V. Evans**<sup>1</sup>, Chris P. Schwartz<sup>2</sup>, and E. Jeffrey North<sup>2</sup>

HARPER  
2046

<sup>1</sup>College of Arts and Sciences, <sup>2</sup>Department of Pharmacy Sciences, Creighton University School of Pharmacy and Health Professions, Omaha, NE

Transporters belonging to the Resistance-Nodulation-cell Division (RND) superfamily of proteins such as *Mycobacterium tuberculosis* membrane protein large 3 (MmpL3) and its analogs are in the focus of intense investigations due to the importance of these proteins in the physiology of Corynebacterium-Mycobacterium-Nocardia species and anti-tuberculosis drug discovery. MmpL3 is an essential transporter protein involved in mycobacterial cell wall biosynthesis. Specifically, MmpL3 shuttles mycolic acids, which are the primary lipid component of the mycobacterial cell wall, in form of trehalose monomycolate (TMM) conjugates from the inner membrane to the periplasm. Mycolic acids are beta-hydroxy fatty acids containing up to 90 carbons. This substrate can be fluorescently tagged to understand the mechanism of MmpL3 to better understand how to effectively inhibit mycobacteria cell wall biosynthesis. MmpL3 structure and its mechanism has spurred increased research of this enzyme's mechanism and could lead to a new field of antibiotics. In this study, we designed a multistep synthesis of short chain TMM analogs and were able to successfully synthesize key intermediates in moderate to good yields (30-60%), characterized by <sup>1</sup>H NMR and mass spectrometry. Once completed, these short chain TMM analogs will be evaluated in microbiological and biophysical assays to gain improved understanding of MmpL3 substrate recognition and transient function.

11

10:00 AM  
HARPER  
2046*ERK 1/2 Inhibitor AZD-0364 Mitigates Noise-Induced Hearing Loss in Mice*Richard D. Lutze, Matthew A. Ingersoll, Daniel F. Kresock, Tal Teitz

Department of Pharmacology and Neuroscience, Creighton University School of Medicine, Omaha, NE

Almost 1.6 billion people are afflicted by some type of hearing loss, yet there are currently no Food and Drug Administration (FDA)-approved drugs to prevent any type of hearing loss. We have recently shown that the mitogen-activated protein kinase (MAPK) pathway is involved with noise and cisplatin-induced hearing loss and demonstrated that dabrafenib, a BRAF kinase inhibitor, protects against both insults *in vivo* while administered at clinically relevant doses. Here, we tested the molecular target ERK, a central node of the MAPK pathway, that to the best of our knowledge has not been targeted directly before for mitigating noise induced hearing loss. AZD-0364, a third generation highly specific ERK1/2 inhibitor, protects against cisplatin-induced hair cell death in cochlear explants with an IC<sub>50</sub> of 5nM. Oral delivery of AZD-0364 mitigated noise-induced hearing loss in adult mice when delivered 45 minutes before noise exposure of 100 dB, 8-16-kHz octave band for 2 hours, indicating it most likely crosses the blood-labyrinth barrier and enters the inner ear. Mice were then treated with AZD-0364 24 hours after noise exposure and similar protection was shown compared to the mice that were pretreated with the compound. Furthermore, dose response of AZD-0364 in mice revealed that protection from noise-induced hearing loss occurred with a dose of AZD-0364 as low as 0.5 mg/kg body weight, given twice a day for three consecutive days. No toxicity was observed with all doses of AZD-0364 tested as measured by weight and behavior of the animals. Ongoing studies include quantifying the mice Organ of Corti Ctbp2 protein in the inner hair cells after noise exposure and AZD-0364 treatment, to examine for better function in synaptic ribbons where inner hair cells form synaptic contacts with neuronal fibers. These preliminary results show that inhibiting ERK alleviates noise-induced hearing loss *in vivo* effectively, and AZD-0364 is a promising therapeutic candidate for noise-induced hearing loss.

12

10:15 AM  
HARPER  
2046*Chemosensing Cross Talk: Implications of Orexin Innervation on the Serotonin System*Samantha Draves, Shruthi Iyer, Stephanie Matthews, and Kristina Simeone

Department of Pharmacology and Neuroscience, Creighton University School of Medicine, Omaha, NE

It is unknown why victims of sudden unexpected death in epilepsy (SUDEP) fail to recover from their last generalized convulsive seizure and subsequent apnea. Strong evidence suggests the chemosensory response responsible for recovery from apnea fails in SUDEP. Orexin and serotonin are two chemosensitive neurotransmitters systems that communicate, although their relationship is not well defined under normal conditions or in epilepsy. We recently reported that orexin is elevated in *Kcna1*-null mouse model of SUDEP and their cardiorespiratory dysfunction is improved by attenuating the orexin chemosensory signals with a dual orexin receptor antagonist. Other studies indicate orexin levels determine whether serotonin cells can fire, to promote respiration and recovery from apnea, or whether serotonin cells are inhibited, and thus promote apnea. It is of high importance to examine if this relationship across multiple chemosensory systems is dysfunctional, which may have implications for SUDEP. Here we tested the hypothesis that orexin signaling onto serotonin cells is increased in *Kcna1*-null mice at high risk for SUDEP.

Immunohistochemistry and unbiased stereological methods were used to quantify the orexin processes in serotonin-rich brain regions that control breathing in *Kcna1*-null mice at high risk of SUDEP and age-matched wildtype controls. We double labeled orexin and tryptophan hydroxylase (enzyme that labels serotonergic cells) in the dorsal raphe, raphe magnus and raphe obscurus. Levels of orexin-immunoreactivity (IR) and tryptophan hydroxylase-IR were determined and the ratio of the two was calculated. There were no significant differences in orexin-IR, tryptophan hydroxylase-IR or the ratios when comparing genotypes. Within the dorsal raphe ventral to the 4th ventricle, there is a privileged subregion with minimal blood brain barrier. This region was subdivided and analyzed to be sure innervation and chemosensory crosstalk did not occur at this unique and physiologically important region. No significant differences were found. These data indicate that the density of orexin-IR projections in these serotonin rich regions do not differ in *Kcna1*-null mice. Our recent data indicate

orexin cells fire at a higher frequency in Kcna1-null mice. Thus, future studies will determine whether quantal release of orexin differs between genotypes using electrophysiology.

**13**  
**10:30 AM**  
**HARPER**  
**2046**

*We Remember: An Autoethnographic Account of the Oklahoma City Bombing*

Sarah Tooley

Department of Communication Studies, Creighton University, Omaha, NE

On April 19th, 1995, 168 lives were lost when Timothy McVeigh blew up the Alfred P. Murrah building in downtown Oklahoma City to avenge the federal government. The more than 500 people injured, all those downtown that day, and generations of Oklahomans and U.S. citizens have been left behind to reckon with the forces of evil that erupted. I combine autoethnographic interviews and field notes from the Memorial to illustrate the realities of that deadly day from perspectives that are often ignored. Interviews from first responders who walked into that rubble, government officials who picked up the pieces of the community, and survivors from the buildings reveal first-hand accounts and experiences that would otherwise be lost to history. Moving through the timeline of the bombing using a “layered account”, I compare participant stories with my experiences of growing up in Oklahoma City with this story and contrast the dominant narrative of public memory of the bombing with their accounts.

**POSTER PRESENTATIONS: 9:00-11:00 AM**  
**WEDNESDAY APRIL 20, 2022**  
**STUDENT ABSTRACTS**

**1**     *Genetic Predisposition to Tinnitus in the UK Biobank Population*

**Madeleine Urbanek**, and Dr. Jian Zuo

Department of Biomedical Sciences, Creighton University, Omaha, NE

Tinnitus, the phantom perception of noise originating from the inner ear, has been reported by 15% of the world's population, with many patients reporting major deficits to cognition and mood. However, both objective diagnostic tools and targeted therapeutic strategies have yet to be established. To better understand the underlying genes that may preclude tinnitus, we performed a genome-wide association study of the UK Biobank's 49,960 whole exome sequencing participants to identify any loci strongly associated with tinnitus. We identified 17 suggestive single nucleotide polymorphisms ( $p < 1e-5$ ) spanning 13 genes in two sex-separated cohorts reporting chronic, bothersome tinnitus (control males  $n = 7,315$ , tinnitus males  $n = 226$ , control females  $n = 11,732$ , tinnitus females  $n = 300$ ). We also found a significant missense mutation in *WDPCP* ( $p = 3.959e-10$ ) in the female cohort, a mutation which has been previously implicated in typical neuronal functioning through axonal migration and structural reinforcement, as well as in Bardet-Biedl syndrome-15, a ciliopathy. Additionally, in situ hybridization in the embryonic and P56 mouse brain demonstrated that the majority of these genes are expressed within the dorsal cochlear nucleus, the region of the brain theorized to initially induce tinnitus. Further RT-qPCR and RNAScope data also reveals this expression pattern. The results of this study indicate that predisposition to tinnitus may span across multiple genomic loci and be established by weakened neuronal circuitry and maladaptive cytoskeletal modifications within the dorsal cochlear nucleus.

**2**     *Development of LC-MS Method for Detection and Quantification of Gentamicin in the Inner Ear*

**Shreshtha Dash**, and Peter Steyger

Department of Biomedical Sciences, Creighton University, Omaha, NE

**Purpose:** Quantifying drugs in the inner ear is challenging due to its small size and relative inaccessibility. The ototoxic drug, gentamicin, is used to treat severe bacterial infections, and consists of 3 major C-subtypes - C1, C1a and C2. Simultaneous detection of these is difficult because gentamicin lacks UV-absorbing chromophores. Liquid chromatography coupled to mass spectrometry can quantify gentamicin due to its high sensitivity and separation of components in biological samples. We present a novel protocol for simultaneous detection of multiple gentamicin components.

**Methods:** We developed an UHPLC-MS method to quantify gentamicin using a Q Exactive<sup>TM</sup> hybrid Quadrupole-Orbitrap<sup>TM</sup> mass spectrometer with ESI interface (Thermo Scientific) coupled to a Vanquish<sup>TM</sup> Flex Binary UHPLC System using an Acquity UPLC BEH C18 column (130 Å, 1.7 µm, 2.1 mm X 50 mm with guard column) and Xcalibur software. Chromatography separation was achieved using a gradient mobile phase of NFPA in water (A), and NFPA in acetonitrile (B) as follows: 0 min: 30% B; 4.0 min: 70% B; 4:10 min: 90% B; 8:00 min: 90% B; 9:00 min: 30% B; 15:00 min: 30% B, for a total runtime of 45 minutes at a flow rate of 0.3 ml/min at 35°C. A range of gentamicin standards (0.1-50 µg/ml) were prepared, with amikacin (1 µg/ml) as an internal standard.

**Results:** Gentamicin could be detected at 0.5 µg/ml, and the standard curve for gentamicin vs ratios of area under chromatogram peaks was linear with  $R^2 > 0.98$ . Fragment ions were seen for each component, with retention times of 2.85- 2.90 min or 2.12 min for gentamicin and amikacin, respectively.

**Conclusions:** A novel UHPLC-MS method was developed to detect and quantify low levels of ototoxic gentamicin in standards and in inner ear tissues.

**Acknowledgement:** Funded by Office of Naval Research and a Bellucci Research Award.

### 3 *Simon Says, Jump! The Neural Manipulation of Crickets' Behavior by Parasites*

**Amanda Cohen**, Allie Jones, and Amy Worthington

Department of Biology, Creighton University, Omaha, NE

Parasitic relationships exist across phyla and can change an organism's reaction to their environment to benefit the parasite's survival, rather than the host's. The exact mechanism of how this occurs however, remains a mystery. Here, I propose neural manipulation, resulting in behavioral changes, and will use the host-parasite relationship between the sand field cricket (*Gryllus firmus*) and the horsehair worm (*Paragordius varius*) to demonstrate this. I will use High Performance Liquid Chromatography (HPLC) to quantify the levels of two vital neurochemicals that modulate behavior (octopamine and serotonin) in the brains of healthy and infected crickets at two critical timepoints of the host-parasite interaction (host sexual maturity and parasite emergence from its host). In addition, I will use histological staining methods to quantify the volume of the lateral accessory lobes and central complex (two areas of the cricket's brain) to determine if plasticity is occurring in infected crickets. Using this proposed experiment, I will be able to 1) see if predictable neurochemical changes occur in infected crickets and 2) determine if neuroplasticity occurs in infected crickets. This research will further our understanding of how parasites manipulate hosts to their benefit and continue to expand our knowledge of the brain.

### 4 *I Got it from Mama: Exploring Trans-Generational Effects of Maternal Infection on Offspring Fitness*

**Kennedy-Kainoa Tamashiro**, and Amy Worthington

Department of Biology, Creighton University, Omaha, NE

Making sure that sufficient resources are available to each system of the body requires a strategic allocation of energy. When one of these processes is strongly activated, there can be significant negative impacts on the other processes. The physiological trade-off between immunity and reproduction is a commonly studied life-history topic; both systems require high energy input and are necessary to ensure that an individual obtains fitness. Importantly, the costs of these trade-offs are not limited to a single generation and can have long-term impacts on offspring physiology. To examine this trans-generational trade-off between immunity and reproduction, we are exploring the effects of a long-lived parasitic infection on female sand crickets, *Gryllus firmus*. Our observations are focused on if increased immune activation has negative effects on reproductive capacity at two time points, during infection and post infection, along with the quality of the resulting offspring. Reproductive capacity and offspring effects are measured by quantifying the following: ovarian mass, number of eggs laid, hatching success of laid eggs, total number of offspring hatched, and average hatchling size. Immunocompromised mothers may invoke an elevated immune response in their offspring, called trans-generational immune priming, via epigenetic changes to their offspring's DNA. Although this may help offspring survive their own parasitic infection, over-investing in immunity as a juvenile may result in decreased reproductive capacity as an adult. To study this, the progeny of the infected and healthy females are raised and their immune function (e.g. LD50 dose and melanization capabilities), body growth, and reproductive investment (sperm viability for males and ovarian mass for females) measured. Our preliminary results suggest that ovarian mass is significantly decreased in parasitized females during infection, preventing the production of offspring. Currently, we are investigating the reproductive capacity of post-infection females and the quality of their offspring.

5

### *Yellow is for Beetles, Blue is for Bees: Differential Sampling Using Pollinator Vane Traps*

**Curtis Lin**, and Theodore Burk

Department of Biology, Creighton University, Omaha, NE

The first important step in any biological conservation effort is determining the population status of the species at a site. For pollinating insects, several different techniques have been used. An increasingly popular technique uses commercially available Blue or Yellow Vane traps. We set out two pairs of Vane Traps, each with one Blue and one Yellow trap, in patches of flowers known to be highly attractive to pollinators, at Glacier Creek Preserve in Bennington, Nebraska. Six sampling sessions were conducted, approximately every two weeks between July and September 2021, with traps in place for 24 hours each session, from one afternoon to the next. We found that Blue Traps captured significantly more insects overall than did Yellow Traps. Yellow Traps captured significantly more beetles, while Blue Traps captured significantly more bees and butterflies. Our results indicate that use of multiple sampling methods may be necessary to accurately sample pollinator populations at sites of conservation importance.

6

### *Efforts to Complete the Horsehair Worm (*C. morgani*) Life Cycle: Exploring the Relationship between Wood Roaches and Mayflies*

**Jessica Jagelski**, John Shea, and Charles Brockhouse

Department of Biology, Creighton University, Omaha, NE

The horsehair worm, *Chordodes morgani*, resides in Nebraskan waters. Despite playing an important role in ecology, scientific knowledge of its life cycle remains incomplete. Previous work showed that wood roaches (*Parcoblatta* spp.) collected from the field harbored *C. morgani*. In the laboratory, wood roaches that consumed mayflies infected with *C. morgani* cysts became infected with *C. morgani*, but we do not know if wild wood roaches become infected in the same way. To test this, we need to examine the gut contents of wood roaches collected from the wild. We used eDNA analysis to determine if mayflies are part of the wood roaches' natural diet. This process includes isolating mayfly mitochondrial DNA (mtDNA) from DNA isolated from woodroach gut contents, amplifying it through a PCR assay with species-specific primers, then sequencing the PCR products for identification. If successful, not only will we be closer to completing the life cycle of *C. morgani*, but parasitologists will have another tool to help elucidate the life cycles of other parasites. Results using self-made primers were inconclusive. However, preliminary results suggest more success has been found using a species-specific mayfly primer.

7

### *Defining the Decline: Extinction is More than the Loss of a Species*

**Emily Fraser**, Julian Garcia, and Andrew Kraemer

Department of Biology, Creighton University, Omaha, NE

Human activity has impacted nearly every terrestrial environment on the planet, leading to the decline and extinction of many species. This study seeks to understand the relationship between species extinction and the decline of morphological diversity, with a particular focus on the endemic Hawaiian tree snails, genus *Achatinella*. Tree snails are valuable species to study because they are highly susceptible to changing environmental conditions and their morphology has likely evolved in response to local environments. Thus, any changes in morphological variation among surviving species may illustrate how this group is responding to ongoing environmental change. Our focus in this project is to characterize the decline in morphological variation as a consequence of extinction, focusing on reductions in the total trait space occupied by surviving species and the distribution of these species in trait space. Preliminary data shows a shift in the trajectory of morphological decline around the year 1960, shortly after a new snail predator was released in Hawaii. This study demonstrates that the loss of species diversity in ecosystems is only part of the story, and that we must also consider the unique attributes of the species being lost to understand the full impact of extinction.

8 *Chemical Analysis of Commercial and Local Honey: Flavonoids, pH, Osmolarity, Antioxidants, Pollen, Phenols, and Hydrogen Peroxide*

**Libbie Smith, Lauren Ross, Haley Frazee, and Allison Benjamin**

Center for Undergraduate Research and Scholarship, Creighton University, Omaha, NE

Honey has been used to aid in wound healing since circa 2000 BC. Honey's chemical properties act against bacterial infection and aid in the wound healing process. Depending on their sources, honeys differ in wound-healing capabilities. Certain properties of honey play large roles in wound healing, especially phenols, flavonoids, pH, hydrogen peroxide, osmolarity, and antioxidants. These properties will be analyzed in honeys from a variety of commercial and local sources. Next, wound healing assays will be completed to determine whether commercial or local honeys are most effective at wound healing. The Folin-Ciocalteu test will determine the total phenol content. A calorimetric method will test the total flavonoid content. pH and osmolarity will be measured using a pH meter and refractometer, respectively. Antioxidant content will also be found using a refractometer. Hydrogen peroxide content will be found by dilution and usage of a peroxide test strip. The acetolysis method will help identify pollen types. Each test will be performed three times on 10 local (pure) and 10 commercial (likely processed) honey samples. In addition, the double-blind procedural method will be used to ensure there is no bias in final conclusions. After performing these tests, the chemical makeup of the honeys can be related to their medicinal wound-healing properties.

9 *Structural Studies of Gene Silencing Proteins: the PCNA and CAF-1 Interaction*

**Keely Orndorff**, and Lynne Dieckman

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

The accurate replication of DNA and the proper packaging of newly synthesized DNA into nucleosomes are two crucial processes for maintaining genomic stability. Nucleosome assembly occurs when the DNA behind the replication fork is immediately wrapped around an octamer of histone proteins, initiating the process of the DNA packaging. This assembly of nucleosomes determines the expression or silencing of genes and disruptions in this process can lead to features of cancer. The interaction between two proteins, proliferating cell nuclear antigen (PCNA) and chromatin assembly factor 1 (CAF-1), is essential for this process of replication-coupled nucleosome assembly. PCNA is involved in DNA replication and the recruitment of many proteins to the replication fork. All proteins that interact with PCNA contain a consensus PCNA-interacting peptide (PIP) motif. CAF-1 is a histone chaperone protein that is recruited to the replication fork by PCNA and deposits histone proteins onto DNA during nucleosome assembly. However, the precise mechanism of interaction between PCNA and CAF-1 remains unclear. This project elucidates the interaction between PCNA and CAF-1 at the structural level using X-ray crystallography. We have solved the structure of a complex of PCNA and CAF-1 to a resolution of 2.6 Angstroms that indicates a novel binding mechanism and provides insight about how the PCNA-CAF-1 interaction contributes to replication-coupled nucleosome assembly.

## 10 *Use of 3D Printed Materials for the Fabrication of Electrochemiluminescent Sensors*

**Patrick Herchenbach**, and Gross, Erin

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Previous work has shown that stencil-printed carbon ink electrodes fabricated in the lab can be used for electrochemiluminescent detection with a smartphone detector. These electrodes have applications in the development of point of care and portable analytical devices. Electrodes fabricated in lab have been shown to be cost effective and customizable. My project seeks to improve the durability and reliability of these screen-printed carbon ink electrodes and to improve the design of my 3D printed light-tight case in which I photograph the reaction. Our previous electrodes were fabricated on now obsolete plastic transparencies. The leads of the electrodes were observed to scratch off with regular use. To maximize durability and to modernize our electrodes I investigated the use of a 3D printed substrate. When the 3D printed surface replaced the transparency, I did not see a change in the cyclic voltametric (CV) behavior of the oxidation of tris(2,2'-bipyridyl) ruthenium(II) chloride ( $\text{Ru}(\text{bpy})_3^{2+}$ ), a common luminophore, 2-(dibutylamino)ethanol (DBAE). An improvement in the durability and reliability of the electrodes was observed. To completely abandon the use of plastic transparencies, I also investigated the fabrication of electrodes with craft vinyl. This fabrication did not change the behavior of the electrodes. The light-tight casing improvements were studied by comparing the ECL intensities of the reaction between  $\text{Ru}(\text{bpy})_3^{2+}$  and DBAE. The revision of the light-tight casing improved the portability of my experimental set up as the experiments no longer needed to be performed in a dark lab.

## 11 *Production of Highly Diverse Lasso Peptides from a Single Biosynthetic Pathway*

**Kelly S. Johnson**, and Benjamin Brandsen

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Lasso peptides are a class of ribosomally synthesized and post-translationally modified peptides (RiPPs) that exhibit a wide range of biological activity. Their threaded lariat structure provides excellent resistance to proteases and constrains their conformation, making them attractive as potential inhibitors for enzymes and protein-protein interactions. This lariat structure, however, makes preparation of lasso peptides by traditional peptide synthetic approaches challenging. Here, we evaluated the potential for the biosynthetic pathway that produces klebsidin, a lasso peptide from *Klebsiella pneumoniae*, to convert highly diverse precursor peptide sequences into mature lasso peptides. By exploiting an intracellular expression assay in *Escherichia coli* where production of a lasso peptide leads to inhibition of cellular growth, we assessed approximately 5,000 variants with 1-4 amino acid insertions in the lasso peptide loop region. Using biological activity as a measure for lasso peptide production, we identified nearly 1,000 precursor peptide sequences that are processed into lasso structures, highlighting the tremendous potential of the klebsidin biosynthetic pathway to produce diverse lasso peptides. For twelve variants that showed inhibition of cellular growth, we verified expression of the expected lasso peptide variant and the expected lariat conformation using mass spectrometry. These results suggest that the klebsidin biosynthetic pathway will be useful for generating libraries of novel lasso peptides.

## 12 *Engineered Variants of the Lasso Peptide Klebsidin*

**Nathan Yoshida**, and Benjamin Brandsen

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

As antibiotic resistance becomes an increasingly prevalent issue in society, the development of new antibiotics is essential for public health. Ribosomally-synthesized and post-translationally modified peptides (RiPPs) are peptide natural products that show potential as new antibiotics. One class of RiPPs are lasso peptides, which are post-translationally modified by biosynthetic tailoring enzymes into a lasso structure. Lasso peptides, however, are challenging to synthesize with traditional chemical methods, limiting exploration of these compounds as potential antibiotics. Using a comprehensive mutagenesis data for the lasso peptide klebsidin, a lasso peptide natural product from *Klebsiella pneumoniae* with antibiotic activity against *Escherichia coli* and *K. pneumoniae*, we attempt to produce heavily mutated variants of klebsidin. We constructed five engineered gene sequences encoding the precursor peptide of klebsidin, and we used these gene sequences to transform *E. coli* for peptide expression. We then analyzed the production of each variant by MALDI mass spectrometry and simultaneously evaluated their capacity to inhibit growth of *E. coli*. Our approach of exploiting mutational analyses to guide the design of new lasso peptides should enable production of new-to-nature lasso peptides in the future.

## 13 *Analysis of Short-Chain Fatty Acids in Bee Guts By GC-MS*

**Elizabeth Baker**, Kayleigh Creager, and Eric Haas

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Short-chain fatty acids (SCFAs) are correlated with overall animal health. We are attempting to isolate and quantify SCFAs from bee mid- and hind-gut due to their role in bee health and ability to resist challenges such as colony collapse disorder. Lipids have been isolated from bee tissues using Folch's solution and the method as modified by Bligh and Dyer. Unlike long-chain fatty acids (LCFAs), SCFAs are extremely volatile, which adds considerable challenges to their isolation and characterization. LCFAs are commonly derivatized to decrease their boiling points to facilitate gas-phase analysis. SCFAs need also be derivatized but generally to increase rather than decrease their boiling points. We produced trimethylsilyl derivatives of four SCFAs: acetic acid, propanoic acid, butanoic acid, and lactic acid. Here we report attempts to isolate the derivatized SCFAs for quantification by gas chromatography-mass spectrometry (GC-MS).

## 14 *Triazole-Containing Benzophenanthridines: Preparation, Characterization, and Antimicrobial Properties*

**Isaac Young**, and James Fletcher

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

It is known that nitrogen containing aromatic rings are common components of bioactive molecules. Specifically cationic phenanthridines are known to exert cell toxicity by intercalating double stranded DNA. Recent work has shown that 1,2,3-triazolium containing phenanthridines display antimicrobial properties that are enhanced when compared to non-annulated diaryl triazolium salts. The goal of this project is to prepare new triazolium-containing benzophenanthridine compounds and compare their antimicrobial properties with previously studied analogs (specifically H and t-butyl substituents). It is hypothesized that the extra benzene ring in the target compounds will enhance its ability to intercalate DNA and improve its overall antimicrobial potency. All target compounds will be characterized by HNMR and mass spectroscopy, and their antimicrobial properties will be studied using minimum inhibitory concentration assays against gram positive bacteria, gram negative bacteria, and yeast.

**15**      *Tridentate Chelators with Thiophene and 1,2,3-Triazole Subunits*

**Kyle McGuire**

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

Coordination compounds are used in a variety of applications such as catalysis, bioimaging, therapeutics and optoelectronic materials. The properties of these compounds can be varied by changing the identity of the metal ion and organic components. Knowledge about tridentate chelators with thiophene subunits capable of binding metal ions is limited relative to N-containing subunits such as pyridine. Click chemistry allows straightforward variation of subunits while preparing triazole-containing tridentate chelators. The goal of this project was to synthesize new tridentate chelators able to coordinate with rare earth and transition metal ions and study the resulting spectroscopic properties. Target ligands have central rings varying between thiophene and pyridine subunits. The pyridine analogs are more well-known and will serve as a comparison for the thiophene analogs. The target ligands also have varying electron density through incorporation of electron donating or withdrawing groups on the peripheries of their two triazole rings. This aims to determine whether the electron density on the triazole group has any impact on the coordination chemistry or its properties. This presentation will describe the organic synthesis behind making the ligands, their coordination properties with Fe(II), Ru(II), Eu(III) and Tb(III) ions, and the characterization of target compounds by NMR, UV-Vis spectroscopy and mass spectrometry.

**16**      *Calcium-Induced Conformational Dynamics of the C-Domain of Tetrahymena Cytoskeletal Protein TCB2*

**Armaan Kumar**, Paul Brian, and Patricia Soto

Department of Chemistry and Biochemistry, Department of Physics, Creighton University, Omaha, NE

Tcb2 is a protein found in the cytoskeleton of the protozoan *Tetrahymena thermophila*. The calcium binding protein has been hypothesized to play roles involved with ciliary movement, pronuclear exchange, as well as cytoskeletal contractions triggered by calcium binding. Solution NMR studies showed that although the C-domain of Tcb2 shares a common structure with other calcium binding proteins (two EF-hand paired motifs), the conformational change as a result of calcium binding differs from calmodulin. Our structural bioinformatics study aims at characterizing the residue-level fingerprint that distinguishes the conformational response of Tcb2 to calcium binding. Our study shows a distinct pattern in local mobility and relative  $\alpha$ -helix orientation in the unbound and bound forms of Tcb2, in agreement with NMR characterization. We will discuss the role of structural domains and residue dynamic couplings to stabilize the calcium-bound fold as well as discuss key residues involved in the overall connectivity of both bound and unbound conformations through centrality analysis. Furthermore, our simulations reveal distinct angles between the four helices in both the bound and unbound conformations in agreement with NMR characterization.

## *Atom Transfer Radical Addition to Alkenes by Copper (II) Complexes with Bis(2-pyridylmethyl)amine*

**Rebecca Powers**, and Kayode Oshin

Department of Chemistry and Biochemistry, Creighton University, Omaha, NE

ATRA is a fundamental reaction within the field of organic chemistry, as it is one of the most economical methods to add halogenated molecules to carbon-carbon double bonds, known as alkenes. It occurs through a free-radical mechanism, where free electrons (radicals) are exchanged and participate in bonding. However, the yield of ATRA is limited due to competing reactions forming unwanted products, such as oligomers and polymers.

Transition-metal catalysts provide an alternate pathway for ATRA reactions to occur. As the reactions are significantly more effective using this alternative pathway, the use of transition metal catalysts has become a popularized method for modifying alkenes. Copper (II) TPMA (tris(2-pyridylmethyl)amine), which is shown in Figure 1, is a known industrial catalyst used in ATRA, with literature values showing an increased efficiency of up to ~90% in certain ATRA reactions.<sup>3</sup> Yet many reactions using copper (II) TPMA are still inefficient due to the geometry of the catalyst. The tripodal ligand arms that surround the copper center hinder the activation site of the catalyst, and therefore decrease its catalytic ability.

My research focuses on modifying the structure of TPMA in the hopes of bypassing this issue. I specifically focused on synthesizing catalysts using the base ligand BPMA, as shown in Figure 2. BPMA has two carbon rings instead of TPMA's three rings. With fewer carbon rings, the activation site of the catalyst is more exposed, theoretically increasing the efficiency of ATRA. I synthesized two modified copper (II) BPMA catalysts, with a three and four carbon OH addition respectively. My heteroscorpionate arm addition could theoretically attach and retract from the activation site. In my research, I synthesized my proposed catalysts, analyzed their structures using <sup>1</sup>H NMR, X-ray crystallography, and mass spectrometry, demonstrated the retractability of the arms, and measured their catalytic capability against copper (II) TPMA in a variety of ATRA reactions.

## *Controlled Metabolic Depression with Adenosine Receptor Agonists*

**Nik Johnson**, Elizabeth Kettler, David Law, Megan Dalicandro<sup>1</sup>, Jake Siedlik<sup>1</sup>, Mitchel Magrini<sup>1</sup>, Joan Eckerson<sup>1</sup>, Kristen Drescher<sup>2</sup>, and Eric Bredahl<sup>1</sup>

<sup>1</sup>Department of Exercise Science and Pre-Health Professions, <sup>2</sup>Department of Medical Microbiology and Immunology, Creighton University, Omaha, NE

Maintaining muscle tissue during prolonged microgravity exposure is key for long-term survival and preservation of functional capacity. A potential approach to minimize muscle loss is to slow the enzymatic processes that underly muscle atrophy. Altering the activity of adenosine receptors can create a system-wide change towards hypometabolism, thus slowing metabolic and enzymatic activity.

**Purpose:** To characterize and identify the optimal dose of 5' adenosine monophosphate (5AMP) and N6- cyclohexyladenosine (CHA) to induce a state of artificial metabolic depression.

**Methods:** L6 skeletal muscle myoblasts were cultured in growth medium (90% DMEM 10% FBS) until they reached 90-95% confluency. Cells were then seeded onto a 96-well plate at a density of 10,000 cells/ml with fresh growth media and incubated for 24 hrs prior to experimentation. Cells were then exposed to growth media containing either CHA or 5AMP at varying doses. Cell viability was assessed immediately after incubation via a Nikon live cell confocal imaging system. Oxygen consumption and glycolytic activity were assessed using ELISA based assays.

**Results:** Both 5AMP (<125 µM) and CHA (<12.5 µM) reduced metabolic activity by 15% and 20% respectively. Furthermore, at the respective doses, there was no significant change in cell viability relative to control cells (P>0.05).

**Conclusion:** Initial evidence suggests that a low dose of CHA and 5AMP can create a moderate degree of metabolic depression.

19

### *Altering the Metabolic of HEK293 Cells with Adenosine Receptor Agonists*

**Megan Dalicandro**<sup>1</sup>, Eric Bredahl<sup>1</sup>, Nik Johnson<sup>1</sup>, Elizabeth Kettler, David Law, and Kristen Drescher<sup>2</sup>

<sup>1</sup>Department of Exercise Science and Pre-Health Professions, <sup>2</sup>Department of Medical Microbiology and Immunology, Creighton University, Omaha, NE

Maintaining kidney health is key for long-term survival, organ transplant, and preservation of cardiovascular function. A potential approach to regulating kidney metabolic activity is with adenosine receptor agonists. The activity of adenosine receptors can create a system wide change towards hypometabolism and thus slowing metabolic and enzymatic activity.

**Purpose:** To characterize and identify the optimal dose of 5' Adenosine Monophosphate (5AMP) and N6- Cyclohexladosine (CHA) to induce a state of artificial metabolic depression.

**Methods:** Human embryonic kidney HEK293 were cultured in growth medium (90% DMEM 10% FBS) until they reached 90-95% confluency. Cells were then seeded on to a 96-well plate at a density of 10,000 cells/ml with fresh growth media and incubated for 24 hrs prior to experimentation. Cells were then exposed to growth media containing either CHA or 5AMP at varying doses. Cell viability was assessed immediately after incubation via a Nikon live cell confocal imaging system. Oxygen consumption and glycolytic activity were assessed using ELISA based assays.

**Results:** Both 5AMP and CHA, at low doses, can reduce metabolic activity, on average, by 5-15% respectfully. Furthermore, at low doses, there is no significant change in cell viability relative to controls ( $P>0.05$ ).

**Conclusion:** Initial evidence suggests CHA and 5AMP, at low doses, can create a mild degree of metabolic depression.

20

### *Relationship Between Measures of Muscle Morphology, Strength, Movement Velocity, and Load-Velocity Profile in Older Adults*

**Abigail Bercich**, Kelley Hammond, Leland Barker, Mae Grahek, Mikayla Grocki, Blake Murphy, Jacob A. Siedlik, and Mitchel A. Magrini

Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE

**Purpose:** The purpose of this study was to examine the relationship between muscle size (QCSA), muscle quality (St), maximal strength, maximal movement speed (MMS), and the load-velocity profile (LVSLOPE) in older adults (OA).

**Methods:** Twelve OA (mean $\pm$ SD; Age=74 $\pm$ 8 yrs) volunteered for this study. Muscle cross-sectional area (CSA) was analyzed offline and averaged to determine quadriceps femoris CSA (QCSA). Participants completed a one-repetition maximum (1RM) on a belt squat machine from which the load-velocity slope (LVSLOPE) was calculated. Load was increased incrementally by 20% of the participant's body weight until they were unable to complete the lift. Maximal strength was determined as the highest load that each participant was able to lift successfully. MMS was determined as the highest mean velocity achieved when lifting the empty rack (~14 kg). The LVSLOPE was determined from the linear regression equation that was developed using the mean velocity and load at each incremental step. Peak isometric force (PF) and peak rate of force development (pRFD) of the quadriceps femoris were defined as the highest 500 ms epoch and the highest 25 ms slope of the force-time curve, respectively. Pearson product correlations were used to analyze the relationships between the dependent variables.

**Results:** QCSA (32.21 $\pm$ 10.45 cm<sup>2</sup>) was positively correlated with pRFD (2241.08 $\pm$ 885.50 N·s;  $R=0.740$ ,  $p=0.006$ ), 1RM (167.20 $\pm$ 39.91 kg;  $R=0.738$ ,  $p=0.006$ ), and PF (376.43 $\pm$ 90.80 N;  $R=0.863$ ,  $p\leq 0.001$ ). Additionally, PF was positively correlated to pRFD ( $R=0.608$ ,  $p=0.036$ ) and 1RM ( $R=0.905$ ,  $p\leq 0.001$ , 95% CI [0.69,0.97]).

**Conclusions:** The non-significant relationship between any of the dependent variables and LVSLOPE may be due to the novelty of the dynamic movement and untrained status of the OA. Further, the

significant relationship between QCSA and 1RM but not QCSA and MMS suggests that the movement speed associated with each incremental load may be limited in the OA and could negatively influence the LVSLOPE.

**Acknowledgements:** This study was funded by the NSCA Foundation young investigator grant.

21

### *Recovery Time-Course of Early and Late Phase Rate of Force Development Following Maximal Eccentric, Maximal Concentric, and Submaximal Eccentric Isokinetic-Exercise*

**Blake Murphy**<sup>1</sup>, Ryan Colquhoun<sup>2</sup>, Sydney Fleming<sup>2</sup>, Nile Banks<sup>3</sup>, Emily Rogers<sup>3</sup>, Jacob Siedlik<sup>1</sup>, Nathaniel Jenkins<sup>3</sup>, and Mitchel Magrini<sup>1</sup>

<sup>1</sup>Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE;

<sup>2</sup>University of South Alabama, Mobile, AL; <sup>3</sup>University of Iowa, Iowa City, IA

The purpose of this study was to investigate the recovery of the rate of force development (RFD) following maximal eccentric (ECC), maximal concentric (CON), and submaximal eccentric resistance-exercise (ECCWM). Eighteen males completed ECC, CON, and ECCWM elbow flexion muscle actions in a quasi-randomized order. Each condition consisted of 6 sets of 10 repetitions. For the initial bout, participants completed either the maximal ECC or CON condition using their dominant arm, the opposite condition using the non-dominant arm, and then the ECCWM condition using the same arm as the CON condition to avoid any repeated bout effects. The total work performed in the ECCWM condition was matched to the work completed in CON. Participants completed two rapid, maximal voluntary contractions of the forearm flexors prior to (Pre) and immediately after (Post), 1-hour (Post1), 24-hours (Post24), 48-hours (Post48), and 72-hours (Post72) post-exercise. The RFD was separated into two phases (RFDphases). Early phase RFD was defined as the first 50ms (RFD50) and late phase RFD was defined as the 100-200ms (RFD100-200) of the best rMVIC. Separate 2 × 3 × 6 repeated measures ANOVAs were used to examine mode-related differences in RFD50 and RFD100-200. No 2- or 3-way interactions were observed (all  $p = 0.081 - 0.237$ ). A main effect for RFDphase ( $p \leq 0.001$ ) was observed, where RFD50 was lower than RFD100-200 when collapsed across time and conditions. A main effect for time was also observed ( $p \leq 0.001$ ). Pre RFD was greater than Post ( $p \leq 0.001$ ,  $g = 2.49$ ), Post1 ( $p \leq 0.001$ ), and Post24 ( $p \leq 0.001$ ) when collapsed across condition and RFDphase. Further, Post was lower than Post48 ( $p = 0.003$ ) and Post72 ( $p \leq 0.001$ ), and Post1 was lower than Post72 ( $p = 0.004$ ). These results suggest that contraction type has no bearing on the time course of recovery for early or late phase RFD. Furthermore, both early and late phase RFD are similarly depressed during the 24-h following eccentric and concentric-only exercise bouts but recover within 48-h.

22

### *The Evaluation of Body Composition Characteristics in Patients with Osteogenesis Imperfecta*

**Jacqueline Kay**, Mackenzie Kilton, Ally Thavenet, Sydney Forgarty, and Joan Eckerson

Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE

**Purpose:** Osteogenesis imperfecta (OI) is an inherited bone disorder that affects type I collagen and is characterized by frequent fractures, bone deformities, and short stature. Physical function is limited depending upon the severity of OI type (I – IV) and may contribute to obesity and associated comorbidities. Although body mass index (BMI) is often used to assess overweight and obesity, it has limitations because it does not distinguish between the amount and distribution of body fat (BF) and fat-free mass (FFM). Understanding the body composition (BC) characteristics of patients with varying forms of OI is important for healthcare professionals to improve disease management and the long-term health in this population. Therefore, the purpose of this review was to determine the BC characteristics of patients with varying forms of OI.

**Methods:** Databases MEDLINE and SportsDiscus were used to find studies that investigated BC characteristics in patients with OI. MeSH and key words used in the search included “OI AND BC or BF or FFM”, “OI AND anthropometric measurements,” and “OI AND obesity or adiposity.”

**Results:** A total of 14 studies were reviewed. Study inclusion criteria included: estimation of BC, anthropometry/anthropometric measurements, nutritional status and adiposity, growth patterns, and

developmental charts in children and adults with OI. Results showed significant differences in BC characteristics between OI types.

**Conclusion:** The findings indicate that patients with more severe types of OI (III and IV) have shorter stature, higher BMI and BF, and lower FFM compared to OI-I. Skinfold thicknesses and circumferences were correlated to nutritional status and BF, with OI-III demonstrating higher energy intakes. The findings suggest that regular assessment of BC and nutritional status is necessary to guide decisions regarding diet, exercise, and long-term health in this population, and that patients with OI-III are at a greater risk for obesity related metabolic disease.

## 23 *The Effects of KMT5B Gene Dosage on Mouse Lung Development and Morphology*

**Rebecca Black**, and Holly Stessman

Department of Neuroscience and Pharmacology, Creighton University, Omaha, NE

KMT5B is a histone modifying gene which methylates lysine 20 residues on the tail of histone H4 (H4K20). Increasing H4K20 methylation functions to repress gene expression. Heterozygous loss-of-function mutations in the KMT5B gene have been identified among neurodevelopmental disorder cases; germline Kmt5b haploinsufficiency in mice appears to phenocopy many aspects of the patient condition. However, identifying the effects of full KMT5B knockout has been difficult as KMT5B-null mice expire in-utero or shortly after birth. In 2008, Schotta, et al. attributed this perinatal lethality to “alveolar defect in the lungs” without providing any data to support this conclusion. To test their hypothesis, we independently-derived a KMT5B knockout mouse model using a gene trapping strategy. We harvested KMT5B heterozygous (HET) and wild-type (WT) mouse lungs at postnatal day (P) 0 and P17 and analyzed their pathological structures with the “PAP” software created by Rui Xiao et al (2016). We identified significantly greater lung area in HET compared to WT pups at P0 ( $F(1, 23) = 17.67$ ;  $P=0.0003$ ; 2-way ANOVA) and at P17 ( $F(1, 33) = 7.867$ ;  $P=0.00840$ ). P0 HET lungs were further characterized by significantly decreased alveolar ( $F(1, 23) = 11.91$ ;  $P=0.0022$ ) and increased saccular ( $F(1, 23) = 24.30$ ;  $P<0.0001$ ) proportions of the total lung area. An increased saccular fraction was also observed among HET lungs at P17; however, this was not significant due to high inter-animal variability. A significantly increased number of alveoli were present in P0 HET lungs ( $F(1, 23) = 7.819$ ;  $P=0.0103$ ), yet these were significantly smaller ( $F(1, 23) = 10.08$ ;  $P=0.0042$ ) compared to WT lungs. Alveolar count and size did not differ at P17. Taken together, we propose a precocious alveolar differentiation defect in HET animals resulting in a hyperinflation lung phenotype.

## 24 *Expression of Apoptosis Markers in the Nasal Cavity of Hamsters*

**Yashmita Malhotra**, and Anthony Kincaid

Department of Pharmacy Sciences, Creighton University, Omaha, NE

Epithelial tissues undergo regular cell turnover which results in the replacement of damaged or aging cells. Apoptosis cascades initiate and regulate events that allow for the controlled cell death and recycling of cellular materials. Apoptosis is triggered through two pathways that are regulated by initiator caspases, such as caspase-9, and executioner caspases, including caspase-3. Apoptosis is also regulated by BCL-2 proteins, which act as apoptotic inhibitors and inducers, as well as TNF, which acts as an apoptotic inducer through activation of type 1 receptors. The nasal mucosa is an example of an epithelium that has important barrier properties and as such is of interest as a site for drug and vaccine administration, and as an entryway for disease. The mechanism(s) of normal cell turnover are not known for the respiratory epithelium that lines the surfaces of the mammalian nasal cavity. The goal of this project was to determine if markers for apoptosis could be detected using immunohistochemistry (IHC) in decalcified tissue samples to determine the spatial pattern of cell turnover in the nasal cavity. IHC was used to visualize expression of caspase-3, caspase-9, BCL-2, and TNF within the nasal cavity of hamsters. While the expression of caspase-3 as detected by IHC on this tissue was consistent with a potential pattern of cell turnover, the expression of the other candidate proteins as detected by IHC was not. The failure to detect markers of apoptosis in this tissue may be due to the loss of epitopes during the decalcification process, or to some other technical issue.

## 25 *The QED Beta-Function*

### Quintin Muhlenkamp

Department of Physics, Creighton University, Omaha, NE

Quantum electrodynamics (QED) is a quantum-relativistic theory for electromagnetism. It is among the most successful quantum field theories, which collectively describe the dynamics of elementary particles at high energies. Unfortunately, the dynamical expressions for interacting theories do not have analytical solutions. Approximate solutions are obtained through perturbation theory, although a significant obstacle is encountered when some of the terms in the expansion diverge. These divergences have historically caused much debate around the legitimacy of QED, and it was not until the modern theory of renormalization and the invention of the renormalization group that QED gained a wider acceptance as a legitimate calculational tool. The renormalization group yielded surprising physical consequences, such as running coupling constants and anomalous dimensions. Of primary interest to this presentation is the beta-function of QED, a result of the renormalization group that describes the dependence of the electric charge on particle momentum. The beta-function is of both theoretical and experimental importance, as its derivation yields information about the legitimacy of perturbation theory, the presence of a Landau ghost, and the electric charge polarization of the vacuum; the latter of which is a contribution to the famous Lamb shift. This presentation exhibits the renormalization procedure for QED, derives the beta-function of the theory, and discusses its implications.

## 26 *Deep Learning for Automated Image Segmentation in Optical Skin Cancer Imaging*

### Tyler Farr, and Michael Nichols

Department of Physics, Creighton University, Omaha, NE

**Purpose:** Recent advancements in optical imaging show promise for skin cancer imaging and diagnosis. Specifically, the optical imaging techniques known as second harmonic imaging microscopy (SHIM) and two photon excitation fluorescence (TPEF) provide valuable metabolic and structural insights. These insights may lead to the ability to in-vivo diagnosis of skin cancer, potentially eliminating the need to excise tissue. These potentially game-changing techniques may be capable of generating large volumes of images which may be quickly analyzed through use of a convolutional neural network (CNN). CNN architectures have been developed specifically for the purpose of biomedical image segmentation and may be trained to interpret images quickly and cheaply. In this project we seek to train a CNN which is capable of accurately and reliably segmenting SHIM and TPEF acquired images with the intent on providing quantitative insights which may be relevant to patient prognosis.

**Methods:** The Python libraries Keras and TensorFlow, in combination with Google Colaboratory were used to create a convolutional neural network. Previously acquired images in the lab were used to train and test the network to ensure proper performance prior to deployment on larger datasets.

**Results:** Preliminary model performance was acceptable, but subject to major pitfalls. To avoid these pitfalls we modify the training set to improve model predictive ability. Random sampling to compose a new training set resulted in improved model predictions on unseen images.

**Conclusions:** Deep learning techniques, in combination with improved optical imaging, show potential for quantifying image features. Random sampling techniques lead to more representative training sets, which in turn improves model predictive ability.

27

### *Impact of Cell Culture Conditions on Assessment of Cellular Metabolism in vitro by NAD(P)H Phasor FLIM for Non-Invasive Biopsy*

**Alicia Nguyen**<sup>1</sup>, Michael Nichols<sup>1</sup>, Tyler B. Farr<sup>1</sup>, Hayden M. Hubbs<sup>1</sup>, Connor J. Kalhorn<sup>1</sup>, Cecilia Myers<sup>1</sup>, Alicia C. Nguyen<sup>1</sup>, Samuel J. Rogers<sup>1</sup>, Daniel R. Snyder<sup>1</sup>, Thien Q. Tran<sup>1</sup>, George Varghese<sup>1</sup>, Daniel H. Wood<sup>1</sup>, Dan L. Pham<sup>1</sup>, and Laura A. Hansen<sup>2</sup>

<sup>1</sup>Department of Physics, <sup>2</sup>Department of Biomedical Sciences, Creighton University, Omaha, NE

The current method in diagnosing skin cancer utilizes punch biopsy, which is an invasive method that has several adverse consequences. A potential alternative to the current method is using non-invasive optical biopsy to monitor metabolic changes in cancer cells. The optical biopsy would allow for detection prior to development of cancer phenotypes on the skin required for punch biopsy to be administered. Due to the affiliation between HER2 expression and tumorigenesis, as well as the hypoxic environment expected of tumors, we investigated the impact of HER2 inhibition and oxygenation on metabolism in vitro. We quantified the effects of oxygenation and HER2 inhibition on NAD(P)H bound fraction, intensity, and electron transport chain activity in both Squamous Cell Carcinoma (SCC) and established breast cancer cell lines. In all the breast cancer cell lines, the inhibition of HER2 reduced the NAD(P)H bound fraction while increasing the concentration of NAD(P)H, but this was not observed in the HER2 overexpressing SCC74B cell line. In addition, reduced response to ETC inhibition and uncoupling was observed. Particularly, cells cultured under hypoxic conditions exhibited these differences to a greater degree. These results suggest an interaction between HER2 expression, ETC regulation, and glycolysis by successfully identifying differences in environmental variables including oxygenation and HER2 expression. Our findings suggest that cell culture experiments performed at atmospheric oxygen do not reflect cellular energetics that are typically seen in vivo.

**Acknowledgements:** This publication was made possible by grants from the National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH), and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

28

### *Effects of Microgravity on Cancer Cell Response to Chemotherapeutic Drugs*

**Adam Taylor**, Spencer McKinley, Conner Peeples, and Dr. Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

Microgravity or the condition of apparent weightlessness causes bone, muscular and immune system dysfunctions in astronauts following spaceflights. These organ and system-level dysfunctions correlate with changes at the single cell level both by simulated microgravity on earth as well as microgravity conditions in outer space. Reported changes in single cells include structural/morphological abnormalities and changes in gene expression and signaling pathways, suggesting that cells mount some adjustments to microgravity. However, the implications of such adjustments on many cellular functions are not clear largely because the primary mechanism of gravity sensing in animal cells is unknown. Here, we used a rotary cell culture system developed by NASA to subject hematopoietic cancer cells (K562) to microgravity for 48 h and then quantified their innate immune response to common anti-cancer drugs (paclitaxel and hydroxyurea) using biophysical parameters and fluorescence microscopy. We find that microgravity changes the viability and nuclear-to-cytoplasmic ratio of treated cells in a drug-dependent manner.

## *Exploring Biophysical Mechanisms of Chemotherapy-Induced Metastasis Using Microfluids*

**Kylie Machida**, Arij Khan, and Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

Current treatment options against cancers (radiotherapy, surgery, chemotherapy, and immunotherapy) target cancer cells and not metastasis. Yet over 90% of cancer related deaths are due to metastasis, the complex process by which cancer cells spread from a primary site to other parts of the body. The recent realization that key steps in cancer metastasis such as migration, extravasation and intravasation involve the mechanical properties of cells, has led to the emergence of Physics of Cancer, a research frontier focusing on the mechanical properties of cancer cells and their role in cancer progression and metastasis. We recently showed in vitro and several groups subsequently reported in pre-clinical studies, patient samples and patient subpopulations that certain chemotherapeutic drugs inadvertently produce prometastatic effects. Hence, there is an urgent search for the mechanisms underpinning chemotherapy-induced metastasis since metastatic disease is the main cause of cancer related mortality. In this project, we investigate whether common chemotherapeutic drugs (Nocodazole, Paclitaxel, Imatinib, Lenalidomide, Hydroxyurea, Temozolomide and Durvalumab) used in treating various cancers (blood, skin, brain cancers) inadvertently cause changes in cell biophysical properties that might promote metastasis through enhanced migration, intravasation and extravasation. The overarching goal of our work is to unravel the role of cell mechanical properties in chemotherapy-induced metastasis. Thus, our hypothesis is that chemotherapy alters the mechanical properties of cancer cells in ways that can inadvertently promote metastasis before cell death. Preliminary results from our microfluidic microcirculation mimetic (MMM) measurements show that Paclitaxel and Nocodazole treated HL60/K562 cells exhibit significantly altered transit times. Other results will be presented. If confirmed, cell mechanical properties would become therapeutic targets against both chemotherapy-induced metastasis as well as metastasis in general. This will lead to better treatment outcomes against cancers.

## *The Role of Cell Mechanics in Chemotherapy-Induced Metastasis*

**Sukhman Viridi**, Nicholas Herrero, Israel Bryant, Destiny Jordan, and Dr. Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

The search for the mechanisms underpinning chemotherapy-induced metastasis is obviously an urgent one since metastatic disease is the main cause of cancer related mortality. We recently showed that Doxorubicin and Daunorubicin, commonly used anticancer drugs, increase cell stiffness before causing cell death, predisposing the cells to clogging and extravasation, the latter being a step in metastasis. Several lines of compelling pre-clinical evidence by other groups following our findings have reported that well known anticancer drugs with therapeutic efficacy on the primary tumor also induce tumor/host reactive responses supportive of dissemination of cancer cell subpopulations. In search of the mechanisms behind such double-edged effect of chemotherapy, we are focusing on cell mechanical properties as possible macroscopic signatures or readouts of molecular level effects. We treat myelocytic (HL60), myelogenous (K562) and lymphocytic (Jurkat) leukemic cancer cells with the drugs Nocodazole, Paclitaxel, Imatinib, Lenalidomide and Hydroxyurea, and then measure their mechanical properties using the microfluidic microcirculation mimetic (MMM) device, which mimics aspects of blood circulation (pulmonary microcirculation) and enables the measurement of cell mechanical properties via transit times through the device. We also measure the migration of cells thus treated to determine the functional relevance of the MMM results. Results from MMM measurements show that Paclitaxel and Nocodazole treated HL60/K562 cells exhibit significantly altered transit times. Other results will be presented. It is already known that Nocodazole and Paclitaxel target microtubules and cell division. However, microtubules along with F-actin and intermediate filaments, determine cell mechanical properties. This work is a contribution to the new research frontier called Physics of Cancer, which focuses on the mechanical properties of cancer cells and their role in cancer progression and metastasis. Specifically, it suggests cell mechanics as a target for much-needed therapeutic agents that have both anticancer and anti-metastasis efficacy.

### 31 *Fluorescence Guided Morphometry in Chemo-Radiotherapy against Brain Cancers*

**Allison Benoit**, Erika Jank, Olivia Salas, Anne Hubbard, Yohan Walter, and Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

Glioblastoma is the most common form of brain cancer affecting over 12,000 people per year in the United States. It is commonly treated with a combination of chemotherapy and radiotherapy but has one of the worst treatment outcomes: a median survival of 12-15 months. In this project, we use a standard clinical combination of Temozolomide and radiation on two glioblastoma cell lines: T98G and U87. To improve therapeutic outcome, we subject the cells to several novel nanoparticles such as graphene quantum dots, serving as radiosensitizers, before chemo-radiotherapy. The chemo-radiotherapy targets and disrupts the structure of DNA in order to harm rapidly dividing cells of the tumor. Fluorescent imaging after exposure to these conditions enables us to detect, evaluate, and quantify morphometric changes in cancer cells. We use the dye Hoechst to stain the nucleic acids, highlighting the DNA material in the nucleus and the dye, Calcein, to stain the cytoplasm, which allows for a comparison between nucleus and cytoplasm. Using morphometric parameters such as lacunarity, circularity, mitotic cell count, and nuclear-to-cytoplasm ratio, we have quantified the damage caused by cell exposure to chemotherapy and radiation. Our results consolidate the clonogenic assays also being done in our lab, enabling further development and refinement of nanoparticle-mediated chemoradiotherapy against brain cancers.

### 32 *How Cell Architecture (Cytoskeleton) Affects Cell Transit Through Microcirculation*

**Isreal Bryant**, Nicholas Herrero, Sukhman Viridi, Arij Khan, Kylie Machida, and Dr. Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

The cellular cytoskeleton plays essential roles for many cellular functions such as cell motility and wound healing. Other cell functions that require shape change or force generation are orchestrated by the cytoskeleton. Actin is one of the main cytoskeletal components that regulate cell mechanical properties. Important features that drive this regulation include the amount of actin and its level of cross-linking. In search for the mechanisms underpinning cell malfunctions in diseases such as cancer and cancer metastasis (the complex process by which cancer cells spread to distant sites away from the primary tumor), we are investigating the role of the actin-cytoskeleton in cell transit through the microcirculation. We use a microfluidic microcirculation mimetic (MMM), which mimics the pulmonary microcirculation, to probe the cytoskeleton of myelogenous leukemia cells (K562) by measuring the transit times through the device. We then disrupt the cytoskeleton of the cells using the depolymerizing drug cytochalasin D (Cyto-D) at different concentrations (2  $\mu$ M and 10  $\mu$ M). This enables comparisons that reveal the role of the cytoskeleton in cell transit through the microcirculation. Our results will hopefully reveal what aspects of cell architecture, if any, contribute(s) to cancer metastasis, thereby providing scientific basis for new and effective anti-metastasis drugs.

### 33 *Novel Analysis of The Accretion Disk Wind Model for Quasar Mass Outflows*

**Jeffrey Brozek**, and Jack Gabel

Department of Physics, Creighton University, Omaha, NE

Quasars are some of the most extreme objects in the universe. They have a supermassive black hole billions of times the mass of the sun, surrounded by a solar system sized disk of gas that's so hot it outshines an entire galaxy. Approximately 20% of quasars exhibit high velocity mass outflows as seen in blue-shifted absorption in the UV spectra. The UV spectra of quasars have broad, blue-shifted absorption lines, referred to as Broad Absorption Lines (BAL). These BAL indicate that there is high energy mass outflow from the quasar. The Accretion Disk Wind model predicts that these outflows are radiationally driven off the accretion disk and is the leading model for BAL. The physical conditions of the BAL outflowing gas are the result of photoionization by the central source. We present a novel analysis of the radiation driven Accretion Disk Wind model for BAL by using a photoionization modeling application called CLOUDY. We vary the physical parameters within Cloudy models to produce ionic column densities that are compared with observations and simulations of the outflows.

*When Subtype and Sex Matter: Investigating Risk of ADHD in Young Children and Children with a Diagnosis.*

**Haylee Hudson<sup>1</sup>, Megan Rothberg<sup>1</sup>**, and Anastasia Kerr-German<sup>2</sup>

<sup>1</sup>Department of Pharmacology and Neuroscience, Creighton University, Omaha, NE; <sup>2</sup>Boys Town National Research Hospital, Omaha, NE

Attention deficit hyperactivity disorder is a neurodevelopmental disorder impacting attention and executive functioning in 7-11% of US children. There are important disparities in population sampling seen in ADHD research. Research linking brain to behavior in ADHD almost exclusively involves males. This data is then generalized to the treatment and understanding of this disorder broadly. Sex biases in clinical practice concerning diagnosing and treating ADHD influence statistics such as, women are more likely to have the inattentive subtype diagnosed later in life whereas men are more likely to have the hyperactive subtype diagnosed in childhood. Our study investigates the relationship between sex disparities and ADHD subtype, in middle childhood, via neural and behavioral measures, where both sexes are explicitly recruited. Results indicate that both sex and subtype of ADHD relate to neural and behavioral findings differentially, demonstrating a need for systemic change in sampling standards for future work with this population.

*The Relationship Between Countermovement Jumps Characteristics and the Dynamic Leap and Balance Test in Soccer Athletes*

**Aya Cote<sup>1</sup>**, Brooke Farmer<sup>2</sup>, Terry Grindstaff<sup>2</sup>, and Abbis Jaffri<sup>2</sup>

<sup>1</sup>Department of Exercise Science, <sup>2</sup>Department of Physical Therapy, Creighton University, Omaha, NE

**Introduction:** Dynamic balance is important while performing movements of everyday activity such as walking, squatting, stair ascent and descent. Dynamic Leap and Balance Test (DLBT) is a novel dynamic balance test in which the base of support is serially changing and leaping movements. However, we don't know if the DLBT is related to counter jump movement characteristics. Therefore, the objective of this study is to evaluate the relationship between counter jump movement and the DLBT in athletes.

**Methods:** This was cross-section lab-based study. 24 (6M;18 F, Age:18.21  $\pm$  0.41 yrs, mass: 66.64  $\pm$  8.37 kgs, height: 168.93  $\pm$  22.46 cm) soccer athletes participated in this study. DLBT trials were conducted and time (in seconds) to complete the task and overall errors made during the task were measured. Moreover, counter-movement jumps were performed by athletes and counter-jump characteristics such as counter jump stiffness landing, concentric force production in counter jump movement or eccentric force production were measured. Right leg was used in all the measurements.

**Results:** We did not find any significant ( $p < 0.05$ ) correlation between counter jump movement characteristics and the DLBT time and errors. Counter jump stiffness with DLBT time had a  $r = -0.26$  as well with DLBT error is  $r = -0.22$ . Concentric mean force and DLBT time and error had a  $r = 0.19$  and  $r = 0.13$ , respectively. Eccentric mean force and DLBT time and error had a  $r = 0.17$  and  $r = 0.16$ , respectively.

**Conclusions:** DLBT should be evaluated, in conjunction with the SEBT, in soccer athletes. The evaluation of counter jump movement is effective in determining the functional performance of soccer athletes. However, it didn't give any information about balance. The DLBT should be used in addition to counter movement jumps for the assessment of dynamic balance.

### *Effect of a Fatiguing Protocol on Maximal and Rapid Force Production in Persons with Parkinson's Disease and Older Adults*

**Elise Choquette**, Mitchel Magrini, Mae Grahek, Jacob Siedlik, and Kelley Hammond

Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE  
Parkinson's disease (PD) is a progressive neurodegenerative disease, which leads to motor dysfunction. However, much is unknown about the peripheral motor deficits at the muscular level. The purpose of this study was to determine the effect of a fatiguing protocol on maximal force and rapid force production in persons with Parkinson's Disease (PD) and non-impaired older adults (OA). Twenty-one individuals (PD=11, OA=10) performed two maximal isometric contractions (MVIC) of the knee extensors. Participants completed a fatiguing protocol consisting of a total of 30 contractions. The highest torque (Nm) achieved during the first, middle, and last contraction was calculated and defined as peak torque (PT). Additionally, peak rate of force development (pRFD) was assessed. PT and pRTD were normalized (PTn and pRTDn, respectively) to the maximal PT and pRTD from the MVIC contraction. Fatigue in PT, PTn, pRTD, and pRTDn was calculated as a percent decline (%decline=100–100(last Repetition/Initial Repetition)). Independent samples t-tests were conducted to investigate the differences in %decline between the groups. Separate 2 × 3 repeated measures ANOVA were run to investigate the differences in PT, PTn, pRTD, and pRTDn between the groups during the fatiguing protocol. A significant difference in %decline in pRTD ( $p=0.010$ ) but not in PT, PTn, pRTDn ( $p \geq 0.05$ ). There was no group × time interaction for PT ( $p=0.898$ ), PTn ( $p=0.774$ ), pRTD ( $p=0.871$ ), or pRTDn ( $p=0.945$ ). A significant main effect for time was revealed in pRTD ( $p=0.038$ ), PT ( $p=0.017$ ), and PTn ( $p=0.002$ ). These data demonstrate a significant difference in pRTD fatigue between the PD and OA groups. However, the difference is negated when pRTD is normalized to account for PT (pRTDn). The elimination of the differences in pRTDn could be due to the PD having an impaired capacity for rapid torque production compared to OA.

### *Scoping Review of Occupational Therapy Assessments for Caregivers of Children with Diabetes*

**Maria O'Brien, Megan Eiberger**, S. Fellman, V.D. Jewell, J. Shin, and E. Knezevich

Department of Occupational Therapy, Creighton University, Omaha, NE

**Importance:** 200,000 American youth under 20 years old are currently living with type 1 diabetes; a number expected to increase to 600,000 by the year 2050 (JDRF, n.d.). This statistic suggests an equally considerable number of caretakers for these medically complex youth. Currently, there is a lack of assessments used in healthcare that measure the wellbeing of caregivers of children with type 1 diabetes, and none exist specific to the field of occupational therapy. Fortunately, occupational therapists have the expertise to create a relevant assessment targeting caregiver health for this population.

**Objective:** This study aims to identify assessments used across health care disciplines that measure psychosocial adjustment, caregiver burden, and health management routines for informal caregivers of children with type 1 diabetes.

**Data Sources:** The researchers searched PubMed, CINAHL, and PsychInfo, in addition to performing a hand search.

**Study Selection and Data Collection:** Following PRISMA guidelines, the researchers screened and appraised articles that included an assessment used to measure psychosocial adjustment, caregiver burden, or health management routines for caregivers of children with type 1 diabetes that were peer-reviewed, written in English, and published since 2011.

**Findings:** The initial search was conducted on October 13, 2021 with 1,620 articles meeting the criteria. After title and abstract screenings, eight of these articles were selected for full-text review. Researchers are in the process of completing a hand search to determine if other established assessments meet specifications for further review.

**Conclusions and Relevance:** Findings will help identify relevant diabetes assessments for occupational therapy practice and can inform practitioners of evidence-based materials to use in addressing health management for caregivers of children with diabetes. The results can further occupational therapy's role in this emerging practice and assist with improving the quality of healthcare outcomes for families of children with type 1 diabetes.

JDRF. (n.d.). Type 1 diabetes facts. Retrieved October 22, 2021, from <https://www.jdrf.org/t1d-resources/about/facts/>

38

### *The Effectiveness of Occupation Based Coaching Among Other Coaching Methods Used in Occupational Therapy Practice: An Integrative Review*

**Leanna Fronckowiak**, Kaitlyn Rambo, J. Shin, and V. Jewell

Department of Occupational Therapy, Creighton University, Omaha, NE

Occupation based coaching (OBC) framework has shown promise in transforming clients into independent problem-solvers in healthcare contexts. In an OBC session, occupational therapy (OT) practitioners and clients collaboratively engage in reflection and problem-solving to achieve self-identified goals through the five steps of Benefit Finding, Reflection and Feedback, Guided Discovery, Joint Plan, and Summary. In the existing literature, however, several other coaching frameworks exist, including occupational performance coaching (OPC), solution-focused coaching (SFC), and coaching in context (CIC), with blurred boundaries in how they are defined and distinguished from OBC.

**Purpose:** The purpose of this integrative review is to (a) compare and contrast existing coaching frameworks to OBC and (b) establish a strong rationale for standardized, manualized OBC to expand its application and utility in the scope of OT practice.

**Methods:** An integrative literature review was completed using a predefined search strategy on available coaching frameworks employed in OT practice, which returned 38 articles: OBC (n=3), OPC (n=25), SFC (n=7), and CIC (n=3). Then, each coaching framework was methodologically reviewed, summarized, and synthesized for comparative analyses.

**Results:** OBC, OPC, SFC, and CIC have been applied to both adults and children from specific diagnostic and community groups with a variability observed in intervention formats and outcomes. Most frequently reported outcomes include achievement of self-identified goals on goal attainment scale and improved occupational performance/satisfaction and self-competence. Despite the promising results, a lack of documentation and standardization among the methods of delivery including dosage and duration, reflective inquiries applied, and outcome measures may pose challenges in recreating the specific coaching intervention to replicate the findings.

**Conclusion:** This integrative literature review revealed significant differences among coaching interventions employed in OT practice. The lack of consensus evident in the existing literature suggests a need for more manualized approach in coaching interventions to improve treatment fidelity and replicability.

39

### *Association Between Hydromorphone Dose and Analgesia in Subjects with Acute Pain in the Emergency Department*

**Katie Sandquist**, Sarah Schumacher, and Ryan Dull

Department of Pharmacy Practice, Creighton University, Omaha, NE

**Purpose:** Hydromorphone is commonly used to manage acute pain in the emergency department (ED). Opioid analgesics are considered high-alert medications because of the significant risk of patient harm when used inappropriately. Uncertainty regarding the optimal hydromorphone dose and a variable pharmacodynamic response are contributing factors to inadvertent hydromorphone toxicity. The purpose of this study is to evaluate the relationship between the initial hydromorphone dose, analgesia, and toxicity in subjects with acute pain in the ED.

**Methods:** In this retrospective cohort study, patients who received parenteral hydromorphone in the CHI Health Lakeside Hospital ED between March 1, 2021, through May 31, 2021 were evaluated for inclusion. The primary dependent variable was analgesia; defined by a reduction of 2 or more from baseline numeric rating scale. The cohort was divided into low-dose (< 1 mg) and high-dose hydromorphone (i.e.,  $\geq 1$  mg) groups. Analgesia and safety outcomes were compared among these cohorts.

**Results:** Of the 177 eligible subjects, 145 were included in the analysis. The high-dose hydromorphone group was significantly more likely to be male, younger, taller, heavier, and have chronic pain. The low-dose hydromorphone group was more likely to have renal impairment. More subjects in the high-dose hydromorphone group reported analgesia and the reduction in pain score following hydromorphone administration was larger in the high-dose group. A multivariate logistic regression model demonstrated high-dose hydromorphone was the only significant predictor of analgesia. No significant difference in safety measures was observed.

**Conclusion:** High-dose hydromorphone was associated with a higher odd of analgesia and pain score reduction without an increased risk for toxicity. The use of fixed-hydromorphone dosing may lead to lower weight-based doses and may contribute to inadequate therapeutic response. Although our regression model was significant, other variables which predict response were not measured in our analysis and require further investigation.

#### 40 *Design, Synthesis and Biological Evaluation of Novel Antimycobacterial Acetamides*

**Katie Cunningham**, Lily Calisto, Sonia Rocha-Sanchez, and E. Jeffrey North

Department of Pharmacy Sciences, Creighton University, Omaha, NE

The continued research efforts into mycobacterial infections, such as tuberculosis (TB), is still very much needed even in the wake of modern medicine. TB infections are estimated by the World Health Organization to affect ten million people per year, and 1.5 million people being killed by the disease. TB is both preventable and a treatable disease but is often difficult to diagnosis in children and adolescents due to being overlooked for other illnesses. As recommended by the American Lung Association, the current treatment that is being used is combination drug therapy of isoniazid, rifampin, pyrazinamide, and ethambutol for six to twelve months. While this treatment is potent and able to completely cure the infection, one of the known side effects of treatment is ototoxicity, which damages the inner ear and often causes irreversible hearing loss. The North lab has discovered lead acetamide-based compounds that retain high potency against mycobacterial pathogens without any noted ototoxicity (in vitro and in vivo); however, these molecules are poorly soluble in physiological aqueous buffers. Two lead acetamides (192 and 200) have a promising in vitro ADMETox profile and have been determined to show no cytotoxicity against a panel of cell lines, are permeable, have high plasma protein binding and are metabolically stable. North 200 has been shown to have rapid absorption after 74 mg/kg and 300 mg/kg oral dosing in mice. This data altogether supports further development of these novel acetamides for treatment of mycobacterial infections.

#### 41 *Identification of Cognitive Domains That Could Influence Motor Preparation Time*

**Ellen So**, Natalie Weaver, and Rosalind Heckman

Department of Physical Therapy, Creighton University, Omaha, NE

**Introduction:** Older adults are known to take longer to move in response to external stimuli. This increase in reaction time with age could result from increased time to prepare an appropriate motor response or delayed initiation of movement to minimize response error. A recent study dissociated preparation and initiation during upper extremity movement and found preparation time increased with age (doi: <https://doi.org/10.1101/2021.06.12.448183>). Cognition also declines with age, but it is unknown if specific cognitive domains contribute to the time required to prepare a motor response. The purpose of this study was to review the literature and identify cognitive domains with age-related changes that could contribute to preparation time.

**Methods:** A literature search was conducted using PubMed and Google Scholar with the search terms attention deficit OR visuospatial OR cognition deficit AND elderly OR older adult OR aging population. The search returned eight relevant articles; five included at least one cognitive domain; perceptual-motor function, executive function, or complex attention; and a measure of upper extremity motor function.

**Results:** While overall measures of cognitive function have had a mixed influence on motor performance with age, motor function was influenced by specific cognitive domains as measured by the Mini Mental State Exam. Visuospatial perception, a component of perceptual-motor function, and executive function, measured by the Montreal Cognitive Assessment were significantly related to motor function. In addition, decreased visuospatial perception influenced motor decision-making, resulting in increased reaction times and response errors. While attention was not significantly associated with age-related cognitive decline, selective attention, a component of complex attention, affected reaction time.

**Conclusion:** Cognitive domains of perceptual-motor function, executive function, and complex attention have been associated with age-related changes in motor function and could contribute to a longer preparation time which will be investigated in future work with older adults.

### *Impairments in Peroneal Activation in Individuals with Patellofemoral Pain in Weight-Bearing Position*

**Amber Schwarting**, and Abbis Jaffri

Department of Physical Therapy, Creighton University, Omaha, NE

**Introduction:** Patellofemoral pain (PFP) is a common musculoskeletal condition for 23% of adults in their lifetime. Recent research has shown that there is foot and ankle dysfunction in people with PFP. Muscular imbalances of the foot and ankle muscles can result in problems at the knee. Peroneal muscles are a group of muscles that maintain foot function and arches of the foot. No study, to our knowledge, has investigated the peroneal muscles of the foot for those with PFP. With the use of diagnostic ultrasound, we measured the muscle thickness revealing the mechanical functions of the foot, such as performance and strength. The purpose of this study was to investigate the size of peroneal muscle using ultrasound imaging.

**Methods:** Peroneal muscles were assessed using ultrasound in the non-weight bearing lying position as well as in the weight-bearing bipedal stance position. The probe was placed at 50% of the fibular length. Three cross-sectional area (CSA) images in each position were taken by placing probe perpendicular to the muscle fiber direction.

**Results:** Thirty PFP (age:  $20.23 \pm 3.30$  yrs, mass:  $74.7 \pm 27.630$  kgs, height:  $161.32 \pm 11.72$ ) and thirty healthy (age:  $20.33 \pm 3.37$ , mass:  $64.02 \pm 11.00$  kgs, height:  $169.31 \pm 9.30$  cm,) individuals participated in this study. There was no difference in peroneal CSA in the non-weight bearing lying position between PFP ( $0.053 \pm 0.010$  cm<sup>2</sup>/kg) and healthy ( $0.051 \pm 0.010$  cm<sup>2</sup>/kg). However, significantly smaller peroneal CSA was found in PFP ( $0.059 \pm 0.011$  cm<sup>2</sup>/kg) as compared to healthy ( $0.065 \pm 0.0008$  cm<sup>2</sup>/kg) in bipedal stance.

**Conclusion:** Peroneal muscles were found to be smaller in size with those with PFP then compared to healthy subjects in the weight-bearing bipedal stance. This study found that those with PFP are unable to activate their lower leg muscles in the functional position. Incorporation of peroneal muscle strengthening, and neuromuscular rehabilitation may help individuals with PFP to improve their functional outcomes.

43

### *Effectiveness of a 6-week Hippotherapy Program for ASD: A Case Study*

**Martyna Adamiec**, M. Kalb, C. Gerlach, M. Almazloum, K. Peck, K. Smith, K. King, E. Godden, D. Katsavelis, and A. Kyvelidou

Department of Physical Therapy, Creighton University, Omaha, NE

**Introduction:** One in 44 children have autism spectrum disorder (ASD)<sup>1</sup>. Hippotherapy (HPOT), a treatment option for children with ASD, has been proven to positively impact various aspects of gross motor and emotional behavior. This 6-week study examines the effectiveness of HPOT on children with ASD as well as the involuntary mutual animal/human influence that occurs during HPOT sessions.

**Methods:** We will present a single participant as a case study that went through our protocol. The participant (6-year-old) with ASD underwent a 6-week HPOT program (30-minute per week). Measures of postural control, social behavior and balance were assessed before and after the 6-week intervention, along with heart rate sensors on the horse and participant. Specifically, we analyzed the level of synchronization of the heart rate responses between horse and participant by using the measure of cross-approximate entropy (CrossApEn). We also collected data from two questionnaires, the Social Responsiveness Scale (SRS) and the ABC scale.

**Results:** After 6 weeks of HPOT the participant improved in social behavior by 6 points. In the pre-evaluation he could not stand still to collect postural control data but on the post-assessment he was able to maintain standing posture for 10 seconds. Overall, his alertness was higher in the post assessment in comparison to the pre-assessment. Values of CrossApEn decreased, which suggests increased synchronization between the horse and the participant as the sessions progressed. Moreover, the participant improved in most domains of the Social Responsive Scale but not on the ABC scales.

**Conclusion:** It is evident that the 6-week HPOT program led to improvements in social and posture behavior. The improvements in these domains are accompanied by the increased synchronization in heart rate between horse and rider, which may aid in understanding why HPOT is an effective treatment tool for children with ASD.

**References:** Centers for Disease Control and Prevention. 2022. Data and Statistics on Autism Spectrum Disorder. [online] Available at: <<https://www.cdc.gov/ncbddd/autism/data.html>> [Accessed 25 February 2022].

44

### *Unveiling Mechanisms of Hippotherapy: Is Physiological Coupling the Answer?*

**Emma Travis**<sup>1</sup>, Hannah Ahlsten<sup>2</sup>, Emily Vierow<sup>1</sup>, Maya Almazloum<sup>1</sup>, Kirk Peck<sup>1</sup>, Katherine Smith<sup>3</sup>, Kaitlann King<sup>3</sup>, Edey Godden<sup>3</sup>, Dimitrios Katsavelis<sup>2</sup>, and Anastasia Kyvelidou<sup>1</sup>

<sup>1</sup>Department of Physical Therapy, <sup>2</sup>Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE; <sup>3</sup>Heartland Equine Therapeutic Riding Academy

**Introduction:** Hippotherapy (HPOT) is a therapeutic service performed to treat a variety of developmental disorders, specifically autism spectrum disorder (ASD). This is one of the first studies that aims to analyze physiological coupling between the horse and rider to determine underlying mechanisms of HPOT.

**Methods:** Ten children participated in the study, five typically developing (TD) and five diagnosed with ASD. Six specialized sessions of HPOT were conducted at Heartland Equine Therapeutic Riding Academy (HETRA). Heart rate (HR) monitors were placed around the upper thorax of both the rider and horse and simultaneously began collecting data at the beginning of each session. Data was collected at the first, third, and sixth sessions. Cross approximate entropy was used to calculate synchronization between horse and rider.

**Statistics and Results:** We performed a 2x3 mixed way ANOVA, with a statistically significant level set at 0.05, and partial eta square was calculated to measure effect size. There was a significant main effect for groups with a moderate effect size ( $F=6.453$ ,  $p=0.032$ ,  $\eta^2=0.418$ ), but no significant main effect for time or an interaction effect. Specifically, the group of children with TD had significantly lower CrossApEn values than children with ASD across all sessions. There was also a decrease in

CrossApEn values across sessions in both groups of children, but not significant, which may indicate greater synchronization as sessions progressed.

**Conclusion:** Greater synchrony between HR of the rider and horse was observed in the TD group compared to the group of children with ASD, but both groups exhibited greater synchrony across session progression. Future studies should aim at examining the effects of higher therapy doses, and if this can cause greater increases in HR synchrony of the horse and children with ASD, trending towards TD children.

**Acknowledgement:** This study was funded by the NIH.

45

*Attention-following and Initiating Joint Attention Improves in Children with ASD after a 6-week Hippotherapy Program*

**Nicholas Garcia**, S. LaMotte, M. Meyer, M. Almazloum, D. Katsavelis, E. Godden, K. King, K. Peck, and A. Kyvelidou

Department of Physical Therapy, Creighton University, Omaha, NE

**Purpose:** The incidence of autism spectrum disorders (ASD) has dramatically increased in the last decade. Hippotherapy (HPOT) has been found to be a successful form of treatment for children with neuromotor delays, but there is little evidence of the effectiveness of treatment for ASD. HPOT involves sensory, neuromotor, and cognitive interactions between horse and rider coupled with one-on-one occupational, physical, and speech therapy. This study aimed to investigate the effects of a 6-week HPOT intervention program on social behavior, and specifically in attention-following and initiating joint attention in children with ASD.

**Methods:** Participants were six children diagnosed with ASD between ages 5-10 years old. Evaluations on social play were performed pre- and post-HPOT sessions in a 10 min semi- structured play over the course of a 6-week protocol. The social play protocol involved attention- following and initiating joint attention based on Watson, Baranek, & Poston, 2003.

**Results:** Paired t-tests were performed on the scores from the pre and post assessments for social play protocol. The results showed that the 6-week program significantly improved ( $p=0.03$ ) attention-following and initiating joint attention in children with ASD with moderate effect size.

**Conclusions:** The findings from this study suggest that even a short duration HPOT program can improve joint initiation and attention following behavior in children with ASD. However, we did notice that high functioning children with ASD might not display any changes in this social play protocol due to ceiling effect. In the future, longer duration studies are needed in addition to exploring other tests of social behavior for high functioning children with ASD.

46

*Sensory Organization during Standing Posture in Children with ASD*

**Miguel Sanchez**, M. Almazloum, N. Garcia, D. Katsavelis, and A. Kyvelidou

Department of Exercise Science and Pre-Health Professions, Creighton University Omaha, NE

**Introduction:** Postural control is crucial for a child's development since it can influence the development of many different motor, cognitive, language, and social skills. Children with autism spectrum disorder (ASD) present deficits in postural control. However, little is known about how children with ASD use sensory information to control their posture. The purpose of this study was to explore any sensory integration deficits in children with ASD using an inexpensive and less time-consuming tool called the Clinical Test of Sensory Interaction and Balance (CTSIB). We hypothesized that the pediatric version of the (P-CTSIB) will be able to capture differences between the two populations.

**Methods:** Participants were 5 children with ASD and 5 neurotypical children. Children were between 5-15 years-old and they were aged-matched. Each child engaged in six sensory conditions of the P-CTSIB test while postural data was collected using a force platform. The conditions involved closing their eyes, standing on a foam pad and wear a visual dome that restricted their vision. Dependent variables were range and sample entropy (SampEn) in the anterior/posterior and medial/lateral directions.

**Results:** SampEn values in both directions were significantly lower in conditions 5 and 6 in which the vestibular system is challenged more for all children. Even though there were no differences between groups, consistently children with ASD demonstrated lower SampEn values across all conditions. In contrast, range in both directions was greater in conditions 5 and 6 for all children, even though across all condition's children with ASD had greater range values.

**Conclusions:** Findings demonstrated that children with ASD were moving more on the extremes of their postural sway (range) and in a more repeatable pattern (SampEn) in comparison to the neurotypical children. All children demonstrated difficulty in controlling posture in conditions where they had to rely mostly on the vestibular system.

47

### *Impact of COVID-19 on Pharmacists in Community Pharmacies in Nebraska: A Mixed Methods Study*

**Rutuja Gadgil**, Mark V. Siracuse, James D. Bramble, and Kevin T. Fuji

Department of Pharmaceutical Sciences, Creighton University, Omaha, NE

**Background:** The COVID-19 pandemic posed significant challenges to the healthcare workforce. The rapid increase in COVID-19 patients combined with the uncertainty surrounding viral transmission and treatment protocols resulted in unprecedented stress and burnout amongst healthcare workers. As other healthcare workers scrambled to support patients, community pharmacists had to quickly respond to the pandemic by extending their services to include COVID-19 testing and increased vaccination capacity. Although studies have examined the psychological impact of the pandemic on frontline healthcare workers, pharmacists are rarely included in these studies.

**Purpose:** To examine the impact of COVID-19 on work and personal wellbeing from the perspective of pharmacists practicing in community pharmacies in Nebraska.

**Methods:** An explanatory sequential mixed methods design will be used. The design consists of two phases. The first phase consists of quantitative data collection and analysis in which survey will be used to collect data from pharmacists working in independent community pharmacies in the state of Nebraska. The subsequent qualitative phase will consist of interviews with selected respondents to the survey to help confirm/explain the quantitative findings.

**Results:** Data will be collected in the second half of 2022.

**Possible Study Implications:** The study will highlight pharmacist's work and contribution during the pandemic. It will also display problems faced by pharmacists at their workplace as well as personally. Results of this study will help us to understand from a pharmacist's perspective what problems were faced in the regular functioning of their community pharmacy due to COVID-19. This study will also help us gauge the pharmacist's emotional needs and how that influenced their work during the pandemic. Findings can be used to support pharmacists, pharmacist employers, and subsequently the patients they serve.

48

### *Life after Vaccine: A Qualitative Assessment of Post-HPV Vaccination Risk Compensation among Young Adults*

**Emily Fraser**, Jean Kanaparti, and Amy Soeun

Department of Cultural and Social Studies, Creighton University, Omaha, NE

Using qualitative methodologies, we assessed risk compensation following HPV vaccination among young, college educated adults. Since 2006, the vaccine against the human papilloma virus (HPV) – the most common sexually transmitted infection – has been administered to teens. One understudied side-effect of HPV vaccination is risk compensation – the adjustment of individual behaviors in response to perceived changes in risk. Social science research has explored HPV vaccination hesitancy, but post-HPV vaccination behaviors have received little attention. We evaluated vaccinated young adults' attitudes regarding preventive screenings and high-risk sexual activity. After conducted an extensive literature review, we administered a short survey to more than 100 college students. With a selected

group, we conducted a few in-depth, open-ended interviews. Our findings suggest that, despite uneven knowledge about the HPV and the full range of benefits of the HPV vaccine among young adults, the overall levels of risk compensation are low. Young, college-educated adults tend to have a complex and thorough understanding of biomedical risks related to STIs. HPV vaccination status does not seem to significantly modulate risk behaviors. The project fills a gap in the post-HPV vaccination risk compensation research while also producing knowledge that illuminates post-vaccination behaviors in general.

49

### *The Relationship Between Dental Modifications and Dental Pathologies in the Classic Period Maya*

**Maya Day**, and Erin Blankenship-Sefczek

Department of Cultural and Social Studies, Creighton University, Omaha, NE

Social practices, such as dental modification, are signs of cultural identity and social membership. Individuals who possessed modification often belong to higher social status groups. This may ultimately lead to overall better oral health profiles for individuals with modifications as their higher status is typically associated with greater access to resources than individuals of lower status groups. However, despite overall better oral health, cultural alterations may be affecting the modified tooth in the form of caries formation and dental attrition. This study looked at dentition from Classic period Maya individuals (n=42) from elite, middle and lower status groups. We predicted that teeth affected by modification will exhibit more caries and attrition compared to teeth without modification between social groups. Type and location of dental modification, caries and dental attrition were recorded following standard protocol methods. Results show that higher status and middle status individuals exhibit the highest frequency of modification on maxillary incisors and canines, but there is not a significant difference between social groups. Analysis of caries indicate the presence of modification does not affect formation of enamel lesions. For dental attrition of anterior teeth, a statistically significant difference was found between social group ( $p=0.01$ ). This was being driven by the lower social group who showed more wear on the anterior teeth but also exhibit comparatively fewer modifications. Therefore, this pattern suggests the cultural practice of dental modification did not impact the formation of wear. Contrary to predicted, our findings suggest that while dental modification is an indicator of socioeconomic status, in this population, it did not differentially affect the presence and severity of caries and attrition. The difference of attrition observed between social groups is more likely contingent on lifestyle differences like the tool use of teeth.

**Acknowledgements:** This study was funded by Creighton University's Center for Undergraduate Research and Scholarship Summer Undergraduate Research Fellowship.

50

### *Interdisciplinary Leadership Within Military Healthcare*

**Morgan Day**, and Candace Bloomquist

Department of Interdisciplinary Studies, Creighton University, Omaha, NE

As inequities in healthcare continue to grow, there is an increasing need for leaders in healthcare to collaborate in order to equitably apportion resources and services, administer care, and see to the coordination of public and organizational policies. Due to the broad nature of this challenge, healthcare leaders have begun to reach across their disciplines and sectors to find solutions, creating the need to find ways to work among different groups effectively. The practice of interdisciplinary leadership offers a framework for leaders to follow that enables them to communicate, cooperate, and coordinate their efforts to better serve the needs of their patients. This phenomenological study examined the interdisciplinary leadership experiences of healthcare leaders within the U.S. military. We found that five factors describe participants' experiences, i.e., interdisciplinary leadership involves (1) building trust through being present, (2) committing to open-mindedness, (3) maximizing the strengths of others within your team, (4) prioritizing the needs of the patient, and (5) using flexible, consistent communication. The unique environment and structure of the military healthcare system provide insight into what conditions are necessary for promoting interdisciplinary leadership. This research builds on past empirical and conceptual studies of interdisciplinary leadership by Dr. Candace Bloomquist and her colleagues. Based on the results of these studies we propose that leaders in healthcare and other

fields interested in addressing complex problems, like health inequities, use interdisciplinary leadership as a leadership development model.

## 51 Application of the Health Belief Model to Develop Targeted Messaging to Midwest Residents about Flood Risk

**Kevin Boes**, Timothy Guetterman, and DT Ratnapradipa, DT

Department of Interdisciplinary Studies, Creighton University, Omaha, NE

**Background:** River flooding represents a significant health risk to many residents of the Midwest. To better prepare communities for flooding events, researchers and risk communication professionals need ways to effectively convey flooding-relevant health information. The purpose of this presentation is to demonstrate how to use behavioral theory to inform risk communication messaging for the public.

**Theory:** The Health Belief Model (HBM) is a widely accepted behavioral theory used to inform public health studies and interventions. Key constructs applicable to risk communication include individuals' beliefs about the likelihood they will be affected by a given health outcome, severity of the health outcome if they are affected, perceived benefits of pursuing the health behavior, perceived barriers to pursuing the health behavior, and perceived social values influencing their decision to pursue the health behavior.

**Methods:** HBM constructs will be highlighted as they pertain to model decision-making about developing a personal or household flood plan.

**Application to Practice:** Using this model can allow risk communication professionals to effectively identify specific aspects of risk perception for which they can provide focused health education interventions aimed at reducing the impact of flooding for Midwest residents. However, the HBM may focus on individual-level factors at the expense of structural factors which can also influence health behaviors. Consequently, use of the HBM without consideration of context might waste resources providing health education to communities most significantly limited by structural factors.

## 52 *Disease and Disparities: A Study of the Social Inequalities of the 1918 Influenza Pandemic in Kansas City*

**Eve Aspenwell**

Department of History, Creighton University, Omaha, NE

My research investigated the social-environmental determinants of the 1918 influenza pandemic using Kansas City, Missouri as a case study. Over the summer of 2021 I transcribed death certificates (available online) from the deadliest months of the pandemic. I then geospatially plotted the death records to help determine a pattern within them that was influenced by social factors. Finally, I used primary historical research to understand my findings and the urban environment surrounding them. My CURAS Undergraduate Summer Research Fellowship was extremely important in supporting my research to understand how human decisions impacted disparities in influenza mortality, thus contributing to the scholarly discipline of environmental history with a focus on environmental justice.

## 53 *Lucas Cranach the Elder's Venus and Cupid Paintings: Changing Symbols in Religious Art During the Protestant Reformation*

**Olivia Kiernan, Emily Unsen, and James Barry**

Center for Undergraduate Research and Scholarship, Creighton University, Omaha, NE

The Protestant Reformation transformed religious art with novel symbolism. Protestant art re-examined traditional Catholic symbols and teaching and told old stories intertwined with revolutionary ideas. While artwork during this period has been widely examined, Lucas Cranach the Elder's Venus with Cupid stealing honey in front of a black background and Venus with Cupid as Honey Thief and specifically, their use of bees as a Protestant symbol, has not been developed. The characterization of Cupid, the sexualization of Venus, and the role of both bees and the background, are portrayed differently between these renderings. The honeycomb is representative of the indulgence of the church and the bees' sting

is indicative of the consequences of their greed. By examining these specific areas of interest, we will discover connections between natural symbolism and the inspiration of the Reformation. Bees are transformed into punishment for indulgence, evoking the humility of early Protestant thought. Lucas Cranach the Elder's paintings meaningfully reflect religious reforms happening in the real world, allowing further insight into the thinking behind the Reformation. Our discovery will provide insight into the unique aesthetic foundation of Protestantism against Catholicism, including a significant symbol, bees, redefined from godliness to justice.

## **54**      *Are Younger Generations Killing American Democracy*

### **Karen Crouch**

Department of Political Science, Creighton University, Omaha, NE

The goal of this research is to explain generational differences of trust or distrust in government. The research tests if Generation Z and young Millennials have less trust in the government than older generations in Model 1. Model 2 focuses on Generation Z and young Millennials, using age as a control, and applies social explanatory variables, such as use of Facebook, views on Iran and COVID to explain possible factors that lead to distrust in the government. Model 1 findings suggest younger generations have different levels of trust in the federal government. Among Generation Z, education and Facebook showed inconsistent trends towards trust in government, while COVID approval ratings correlated with more trust.

**ORAL PLATFORM PRESENTATIONS: 1:30-3:30 PM**  
**TUESDAY APRIL 19, 2022**  
**STUDENT ABSTRACTS**

1

**1:30 PM**  
**HARPER**  
**2045**

*Neuromuscular and Morphological Factors do not Contribute to Quadriceps Weakness following ACL Reconstruction: A Preliminary Investigation*

**Caitlin Frie**<sup>1</sup>, Brooke Farmer<sup>1</sup>, Kelley Hammond<sup>2</sup>, and Terry Grindstaff<sup>1</sup>

<sup>1</sup>Department of Physical Therapy, <sup>2</sup>Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE

**Purpose:** Anterior cruciate ligament (ACL) injury is associated with short-term disability and increased potential for the development of post-traumatic knee osteoarthritis. Quadriceps weakness is a common post-surgical impairment and is a modifiable risk factor for the development of knee osteoarthritis. Quadriceps weakness after ACL reconstruction is thought to be due to changes to the local muscle (e.g., atrophy) and in neuromuscular activation (e.g., muscle inhibition), but the underlying mechanisms are not fully understood. The purpose of this preliminary study was to determine between limb differences in neuromuscular and muscle morphological factors that contribute to quadriceps strength.

**Methods:** Seven participants (age=21.9±3.0 years, height=170.6±7.1cm, mass=70.0±12.6kg, Tegner=7.3±2.6, Time post-surgery=49.3±18.8 months) with a history of unilateral ACL reconstruction volunteered for this study. Quadriceps strength was quantified during a maximal voluntary isometric contraction. Percent activation using the interpolated twitch technique was used to quantify neuromuscular contributions to weakness. Morphological variables were measured using ultrasound imaging of the vastus lateralis and included the deep pennation angle, muscle thickness, and echo intensity. Differences between limbs were quantified using paired t-tests.

**Results:** The involved (INV) limb relative to the uninvolved (UnInv) limb produced significantly (p=0.04) lower peak torque (Inv=183.8±77.5Nm, UnInv=209.5±65.8Nm). There were no significant differences between limbs for percent activation (p=0.44; Inv=95.1±8.6%, UnInv=93.7±8.1%), deep pennation angle (p=0.76; Inv=17.2±1.8°, UnInv=17.5±3.3°), muscle thickness (p=0.93; Inv=2.2±0.3 cm, UnInv=2.2±0.5 cm), and echo intensity (p=0.84; Inv=176.3±33.5, UnInv=174.6±20.6).

**Conclusion/Significance:** Despite deficits in quadriceps strength, there were no significant differences in neuromuscular function or muscle morphology between limbs in individuals with unilateral ACL reconstruction. These data suggest other factors likely contribute to the deficits in quadriceps strength of the INV limb. Future studies should examine molecular biomarkers that may contribute to impaired capacity to normalize strength following ACL reconstruction.

2

1:45 PM  
HARPER  
2045*Exploring the Functional Niche of Long Non-coding RNA Expression in Ototoxicity*Collin Jackson, Dr. Annemarie Shibata, Nick Mathy, and Dr. Peter Steyger

Department of Biology, Creighton University, Omaha, NE

Aminoglycoside antibiotics are a subset of antibiotics frequently prescribed in clinical practice because of their effectiveness and relative low cost when treating severe infection. Ototoxicity and permanent hearing loss are recorded in 20-50% of patients with bacterial infections following treatment with aminoglycosides. This damage is exacerbated by infection-induced inflammatory responses in the cochlea. To develop novel treatments for the alleviation or inhibition of these inflammatory responses associated with ototoxicity, we must better understand the molecular mechanisms behind pro-inflammatory pathways - in the inner ear. Preliminary data shows that inflammatory responses in both animal models and in auditory cell lines involve regulation of gene expression by long noncoding RNA (lncRNAs). My *in vitro* data demonstrates that differential expression of lncRNAs in House Ear Institute of Cori 1 (HEI-OC1) auditory cells occurs following exposure to bacterial lipopolysaccharide (LPS). HEI-OC1 cells were unstimulated or stimulated with different concentrations of LPS, a portion of the gram-negative bacterial cell wall. Data suggests that at least lincRNA-Cox2 is significantly overexpressed when auditory cells respond to LPS as compared to controls. **We hypothesize that differentially expressed lncRNAs, like lincRNA-Cox2, may play a role in proinflammatory responses and that blocking these responses will reduce inflammation and ototoxicity seen with aminoglycoside treatment.** To test this hypothesis, *in vitro* and *in vivo* methods will be used. A more robust understanding of the mechanisms of inflammation in the cochlea and the mechanisms of ototoxicity could provide therapeutic targets for the treatment or prevention of hair cell death and hearing loss following antibiotic delivery for ear infections. Given the number of children treated globally with aminoglycosides each year, there is a clear and present need to understand the mechanisms of aminoglycoside-induced ototoxicity.

3

2:00 PM  
HARPER  
2045*Impact of Psychopharmaceuticals in Early Brain and Whole-Body Development*Nathan Zimmerman<sup>1</sup>, Aaron Marta<sup>1</sup>, Carly Baker<sup>2</sup>, Thiago Mattos<sup>3</sup>, Zeljka Korade<sup>3</sup>, and Annemarie Shibata<sup>1</sup><sup>1</sup>Department of Biology, Creighton University, <sup>2</sup>Department of Biomedical Sciences, Creighton University School of Medicine, Omaha, NE, <sup>3</sup>Child Health Research Institute, University of Nebraska Medicine

Genetic mutations in sterol synthesis enzymes are characterized by elevated 7-DHC, reduced cholesterol, reduced desmosterol, and altered acylcarnitine levels. Recently, our collaborators demonstrated that antipsychotics, antidepressants, and antiarrhythmics alter sterol composition of neurons and astrocytes. These drugs also caused an increase in 7-DHC and a reduction in desmosterol levels. Given the prevalence of neurological disorders associated with developmental deficiencies, novel *in vivo* model systems are needed to improve the understanding of how commonly prescribed drugs impact fetal body and nervous system development. Zebrafish are ideal for screening pharmaceutical effects on vertebrate development. Zebrafish and humans express many of the same genes needed for sterol synthesis. The zebrafish model was utilized to test the hypothesis that exposure to pharmaceuticals will alter cholesterol biosynthesis and acylcarnitine levels and disrupt whole body and brain development resulting in abnormal behavior. Wildtype zebrafish were treated with the commonly prescribed antipsychotic cariprazine or AY9944, a known inhibitor of DHCR7 that is used to recapitulate phenotypes of Smith-Lemli-Opitz syndrome, a disorder brought about by mutations in the DHCR7 gene. Vehicle-treated fish were used as controls. Drug treatments of 1 and 10 $\mu$ M were applied 3 days post fertilization until 5dpf. Endogenous cholesterol synthesis begins at 4dpf in zebrafish. Control and treated fish were evaluated at the 5dpf point. Zebrafish were assessed for sterol synthesis, morphology, protein and RNA expression, neuronal network activity, and behavior. Exposure to cariprazine and AY9944 led to a significant increase in 7-DHC levels in comparison to control-treated zebrafish. Morphometric analyses demonstrated significant differences between the larval eye width, rump length, and standard larval length between the groups. Significant differences in behavior between the treated and control groups were observed using the Zebrabox imaging system as well. These data suggest that commonly prescribed pharmaceuticals may have a significant impact on fetal development and brain function leading to abnormal behavior.

4

*The Conversion of Christianity in Japan as Expressed in Endō Shūsaku's Silence (1966)*

2:15 PM

Nina Crabtree<sup>1</sup>, Dr. Jeffrey Hause<sup>2</sup>, and Dr. Lydia Cooper<sup>3</sup>

HARPER  
2045

<sup>1</sup>Department of History, <sup>2</sup>Department of Philosophy, <sup>3</sup>Department of English, Creighton College of Arts and Sciences, Omaha, NE

Endō Shūsaku's novel *Silence* (1966) depicts the era of Christian persecution under the rule of Tokugawa Iemitsu (1623-51). The Jesuits, who just a few decades earlier had found considerable success in their Japanese mission, were targeted as the Tokugawas sought to rid Japan of all Western influence. The enforcers of such policies were the samurai, such as the Interpreter in *Silence*, who translates for the imprisoned Jesuit Sebastian Rodrigues. Despite his earlier confidence in his spiritual willpower, Rodrigues apostatizes. In part, what makes him vulnerable is precisely the similarity between himself and the Interpreter—both serving as educated, cultured, and elite servants to their respective order. Through combined literary analysis and historical research on Samurai and Jesuits in this period, I argue that while similarity may bring two culturally disparate people or groups together, such as the Interpreter and Rodrigues, or the Jesuits and the Japanese, attaining a more than superficial understanding requires sacrifice of key premises in one's own cultural worldview. Endo conveys this thesis through Rodrigues's sacrificing his former idea of God in order to adapt to his environment; but he survived with a new conception, as did Christianity in Japan. This study serves to inform on the significance and impacts of sacrifice in the formation of the history we tell today.

5

*An ODE Model of Yaws Elimination in Lihir Island, Papua New Guinea*

2:30 PM

Presley Kimball<sup>1</sup>, Jacob Levenson<sup>2</sup>, Amy Moore<sup>3</sup>, Jan Rychtar<sup>4</sup>, and Dewey Taylor<sup>4</sup>

HARPER  
2045

<sup>1</sup>Department of Mathematics, Creighton University, Omaha, NE; <sup>2</sup>Department of Mathematics, Washington and Lee University, Lexington, VA; <sup>3</sup>Department of Mathematics and Statistics, Elon University, Elon, NC; <sup>4</sup>Department of Mathematics and Applied Mathematics, Virginia Commonwealth University, Richmond, VA

Yaws is a chronic infection that affects mainly the skin, bone and cartilage and spreads mostly between children. The new approval of a medication as treatment in 2012 has revived eradication efforts and now only few known localized foci of infection remain. The World Health Organization strategy mandates an initial round of total community treatment (TCT) with single-dose azithromycin followed either by further TCT or by total targeted treatment (TTT), an active case-finding and treatment of cases and their contacts. We develop a compartmental ODE model of yaws transmission and treatment for these scenarios. We solve for disease-free and endemic equilibria and also perform the stability analysis. We calibrate the model and validate its predictions on the data from Lihir Island in Papua New Guinea. We demonstrate that TTT strategy is efficient in preventing outbreaks but, due to the presence of asymptomatic latent cases, TTT will not eliminate yaws within a reasonable time frame. To achieve the 2030 eradication target, TCT should be applied instead.

6

### *Ascorbic Acid Reduces Neurotransmission, Synaptic Plasticity, and Spontaneous Hippocampal Rhythms in In Vitro Slices*

2:45 PM  
HARPER  
2045

**Segewkal Hawaze Heruye**, Ted J. Warren, Kristina A. Simeone, and Timothy A. Simeone

Department of Pharmacology and Neuroscience, Creighton University, Omaha, NE

**Background:** Ascorbic acid (AA; also known as vitamin C) is well known for its cytoprotective effects in environments of high oxidative stress. Even though physiological concentrations of AA in the brain are significant (0.2 - 10 mM) due to high metabolic demand, surprisingly little is known concerning the role of AA in synaptic neurotransmission under normal, non-disease state conditions.

**Experimental Design:** Here we examined AA effects on neurotransmission, plasticity, and spontaneous network activity (i.e., sharp waves and high frequency oscillations; SPW-HFOs), at the synapse between area 3 and 1 of the hippocampal cornu ammonis region (CA3 and CA1) using an extracellular multi-electrode array (MED64 Alpha Med Systems, Osaka, Japan) in in vitro mouse ventral hippocampal slices.

**Results:** We found that AA decreased evoked field potentials (fEPSPs,  $IC_{50} = 0.64$  mM) without affecting  $V_{50s}$  or paired pulse facilitation indicating normal neurotransmitter release mechanisms. AA decreased presynaptic fiber volleys but did not change fiber volley-to-fEPSP coupling, suggesting reduced fEPSPs resulted from decreased fiber volleys. Inhibitory effects were also observed in CA1 stratum pyramidale where greater fEPSPs were required for population spikes in the presence of AA suggesting an impact on the intrinsic excitability of neurons. Other forms of synaptic plasticity and correlates of memory (i.e., short- and long-term potentiation) were also significantly reduced by AA as was the incidence of spontaneous SPW-HFOs. AA decreased SPW amplitude with a similar  $IC_{50}$  as fEPSPs (0.53 mM).

**Conclusion:** Overall, these results indicate that under normal conditions AA significantly regulates neurotransmission, plasticity, and network activity by limiting excitability. Thus, AA may participate in refinement of signal processing and memory formation, as well as protecting against pathologic excitability.

7

### *Household Incomes Relation to Accuracy on 'Find the Treasure Task' Within Children*

3:00 PM  
HARPER  
2045

**Shreshtha Ray**<sup>1</sup>, Hannah Wymer, and Anastasia Kerr-German<sup>2</sup>

<sup>1</sup>Department of Psychology, Creighton University, Omaha, NE; <sup>2</sup>Boys Town National Research Hospital, Omaha, NE

Several studies have found a higher prevalence of Attention-Deficit/Hyperactivity Disorder (ADHD) amongst underprivileged and minority populations. However, a very small percentage of those studies explored the prevalence and influence of household income and its relation to a child's accuracy on cognitive tasks, more specifically our "Find the Treasure task." In this study, we gave children ages 2 to 5 a working memory task using a Touch Screen computer. This task was made of 3 blocks (set size 3, 6, 9), each containing 2 parts, and the participants were instructed to find the treasure in each chest. We found that among our sample, the low-income children were far less successful in completing the task (average of over 7 repeats) than the high-income children (average of below 7 repeats). Participants who were both low income and at high risk of ADHD needed significantly more guesses (average of over 13 repeats) to complete the task than participants who were at risk and high income (average of 9 repeats). more Socioeconomic status is a strong risk factor in determining the prevalence of ADHD among children. More research is needed regarding components of Socio-Economic Status and how they affect the prevalence or risk of ADHD. We will continue to follow our sample to evaluate whether the level of accuracy in the Treasure task along with other risk scores were indicative of ADHD diagnosis later in childhood. Future ADHD research should continue to study the correlation between SCS and other environmental risk factors and the prevalence of ADHD. Early intervention and early diagnosis for ADHD should also be explored.

**ORAL PLATFORM PRESENTATIONS: 9:00-11:00 AM**  
**WEDNESDAY APRIL 20, 2022**  
**STUDENT ABSTRACTS**

1

9:00 AM  
HARPER  
2045

***Concurrent Radiosensitization and Chemoradiotherapy for Brain Tumors***

**Anne Hubbard**, Erika Jank, Allie Benoit, Olivia Salas, Destiny Jordan, Yohan Walter, Dr. Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

**Purpose:** Glioblastoma remains the most malignant and most common primary brain tumor in adults, with a median overall survival of only 15 months. This bleak outcome is partly due to the high chemoresistance and high radioresistance of glioblastoma. Current standard of care includes surgical resection, chemotherapy and temozolomide (TMZ) as adjuvant therapy. The purpose of this work is to improve treatment outcomes for highly radioresistant and chemoresistant cancers employing nanoparticle mediated radiosensitization and chemoradiotherapy.

**Methods:** We are using nanoparticle (NP) spectroscopy with a broad range of novel biocompatible nanoparticles including carbon quantum dots (CQD), graphene quantum dots (GQD), and CdSe/Zns quantum dots (QD) based on our recently developed assay involving fluorescence intensity modulation of QDs to assess reactive oxygen species (ROS) generation during chemotherapy and radiotherapy. Our strategy here is to use the NPs for concurrent measurement of ROS and radiosensitization, while applying chemoradiotherapy. We also have a focus on clonogenic assays for cell lines treated with this same broad range of quantum dots with (TMZ) for measurement of cell survival two- and three-weeks posttreatment. Using a standard laboratory cell irradiator (Faxitron), we irradiate glioblastoma cancer cell lines (T98G and U87 cells) treated with QDs, CQDs, and GQDs as well as chemotherapeutic drugs such as Temozolomide (TMZ).

**Results and Conclusions:** Cell survival curves from clonogenic assays show improved cell killing following chemoradiotherapy combined with GQDs, compared to the combination with CQDs. More recent results will be presented. Overall, we have evidence that concurrent radiosensitization using GQDs may lead to improved chemoradiotherapy against glioblastoma cells in vitro.

2

9:15 AM  
HARPER  
2045

## *Genomic and Transcriptomic Variation among Three Representative Clinical Isolates of Extraintestinal Pathogenic Escherichia coli (ExPEC)*

**Courtney P. Rudick** and Nancy D. Hanson

Department of Medical Microbiology and Immunology, Creighton University School of Medicine, Omaha, NE

**Background:** *E. coli* is the most common cause of pyelonephritis and urosepsis - with Sequence Type (ST)131 responsible for most infections worldwide. Previous studies identified *E. coli* isolates XQ12 (ST131) and C15 (ST405) were able to cause sustained bladder and kidney infection in mice, while CUMC247 (ST131) was rapidly cleared. To further elucidate the clinical differences in infectivity, we conducted genomic and transcriptomic analysis on these isolates using whole genome and RNA sequencing.

**Methods:** Isolates were grown to mid-log phase, total DNA and RNA were isolated and whole genome sequencing and RNA-seq was conducted. RNA-seq was performed in triplicate by MiGS. RNA expression data were analyzed using IGV, Gene Ontology Enrichment, and String-DB. Statistical data were analyzed using two-tailed Student's paired t-tests and Fisher's exact test with false discovery rate. Threshold for statistical significance was set at  $p \leq 0.05$ .

**Results:** The number of genes (4494-4601) was relatively consistent between all three isolates. Each isolate had roughly 1300 genes identified as hypothetical proteins. Of the 3200 known genes: XQ12 had 54 unique genes, CUMC247 had 10 genes and C15 had 202 genes not shared by the other two isolates. Compared to CUMC247: XQ12 had 2721 differentially expressed genes with 105 having at least a 2-fold differential; C15 had 2726 differentially expressed genes with 378 having a least a 2-fold differential. Compared to CUMC247: XQ12 and C15 had increased gene expression associated with signal transduction and motility including chemotaxis genes.

**Conclusions:** A greater genetic and transcriptomic similarity was observed between ST131 isolates, however, the genes responsible for mobility were upregulated in XQ12 and C15, the strains associated with kidney infections in mice. Upregulated pathways for cell motility and signal transduction could indicate mechanisms associated with fitness in ExPEC isolates.

3

*Impact of Cell Culture Conditions on Assessment of Cellular Metabolism In Vitro by NAD(P)H Phasor Flim with Application to In Vivo Diagnostic Imaging for Non-Invasive Biopsy*

9:30 AM

HARPER  
2045

**Hayden M. Hubbs**<sup>1</sup>, Tyler B. Farr<sup>1</sup>, Connor J. Kalhorn<sup>1</sup>, Cecilia Myers<sup>1</sup>, Alicia C. Nguyen<sup>1</sup>, Samuel J. Rogers<sup>1</sup>, Daniel R. Snyder<sup>1</sup>, Thien Q. Tran<sup>1</sup>, George Varghese<sup>1</sup>, Daniel H. Wood<sup>1</sup>, Dan L. Pham<sup>3</sup>, Laura A. Hansen<sup>2</sup>, and Michael G. Nichols<sup>1,2</sup>

<sup>1</sup>Department of Physics, <sup>2</sup>Department of Biomedical Sciences, Creighton University, Omaha, NE;

<sup>3</sup>Department of Biomedical Engineering, University of Wisconsin-Madison, Madison, WI

Hallmarks of cancer such as deranged proliferation and altered metabolism characterize tumorigenesis and can be measured with non-invasive technologies such as Fluorescence Lifetime Imaging (FLIM) of endogenous coenzyme NADH. Diagnostic imaging by NAD(P)H FLIM reveals disease progression by characteristic changes in glycolysis, the Krebs cycle, and electron transport chain activity. In vitro experiments on cultured cancer cell lines provides a controlled environment to quantify these metabolic and epigenetic changes. Given that all cells in the body are often exposed to variable levels of oxygen, and rapidly proliferating cancer cells often grow in poorly vascularized, hypoxic environments, we wanted to test the impact low oxygenation conditions would have on cells over an extended period. Specifically, we tested the hypothesis that the overall NAD(P)H bound fraction would change, and thereby signal a shift in dependence on the electron transport chain when cells were grown in a hypoxic environment. Additionally, we wanted to understand whether we would see a difference in cancer cell lines that had high levels of HER2 expression. Our preliminary results suggest this is the case. While cell growth rates and NAD(P)H bound fractions decreased in low HER2-expressing SCC cells grown under hypoxic conditions, growth rates and bound fraction of NAD(P)H in high HER2-expressing SCC cells increased. We then decided to check to see if similar trends could be observed in well-established breast cancer cell lines. In these cell lines, hypoxic conditions led to a decreased NAD(P)H bound fraction and slower growth regardless of HER2 status, while variation in electron transport chain activity was more pronounced in HER2 overexpressing cell lines. These results demonstrate that non-invasive phasor FLIM imaging can quantify changes in cancer cell metabolism induced by both the oxygenation of the tumor as well as the overexpression of HER2.

**Acknowledgments:** This publication was made possible by grants from the National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH), and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

4

*Effects of Klotho-Deficiency on the Brain*9:45 AM  
HARPER  
2045Tavian Sanchez and Gwendalyn King

Department of Biology, Creighton University, Omaha, NE

Klotho is a transmembrane protein most highly expressed by kidney and brain cells, and while the kidney functions of klotho are well-known, brain-specific mechanisms of action remain elusive. Genomic deletion of klotho induces an onset of body-wide premature aging-like phenotypes including hippocampal-dependent memory impairment and neurogenic exhaustion. Strikingly, both mice and humans that produce more klotho protein display enhanced hippocampal-dependent memory function. Overproduction of klotho is likewise protective against age-related declines and neurodegenerative diseases. Although compelling, the data provide no comprehensive model to explain how klotho-deficiency or overexpression affects the function of cells across the nervous system. While most brain-specific studies of klotho's effects focus on neurons, the principal cells of the brain, data show that klotho-deficiency affects oligodendrocyte and microglia function as well. With effects attributed to both cell autonomous and cell non-autonomous klotho activity, we wondered if klotho-deficient effects might derive from klotho's expression in choroid plexus epithelial cells. Choroid plexus cells express the highest levels of brain-specific klotho protein and are the suspected source of shed klotho in cerebrospinal fluid. Using immunohistochemistry, we determined klotho's choroid plexus epithelial cell distribution and surveyed proteins critical for choroid plexus function to determine whether klotho-deficiency impacted protein localization and/or expression level. Results indicate that klotho-deficiency profoundly impacts expression and localization of specific groups of transporter proteins while other proteins are unaffected. When protein expression or localization was affected, the onset of these changes frequently occurred before the onset of impaired cognition, allowing us to speculate that the impairment of the choroid plexus may be driving downstream parenchymal dysfunction. Our data address a gap in our understanding of klotho's function and draw together disparate brain phenotypes into a cohesive model for further investigation.

5

*Regulation of Connexin 43 Phosphorylation by BubR1 Controls Intercellular Communication in the Heart*10:00 AM  
HARPER  
2045Renju Pun and Brian J. North

Department of Biomedical Sciences, Creighton University School of Medicine, Omaha, NE

Sudden cardiac death (SCD) is one of the leading causes of mortality worldwide comprising an estimated 7 million cases per year. Most SCD cases have been attributed to an electrical abnormality called long Q-T syndrome. Recent studies have shown that downregulation of BubR1, a mitotic checkpoint kinase, leads to prolonged Q-T interval *in vivo*. These mice also die in a manner reminiscent of SCD. However, how BubR1 regulates cardiac conduction has yet to be understood. The gap junction protein Connexin 43 (Cx43) is important for electrical impulse propagation through the ventricular myocardium. Overexpression of Cx43 in mice increases susceptibility to arrhythmia and SCD. Therefore, targeting Cx43 may serve as a therapeutic approach for arrhythmia. Cx43 is a transmembrane protein consisting of multiple serine residues whose phosphorylation dictates its function. Among these serine sites, serine-368 (S368) is of particular interest since its phosphorylation initiates the internalization and degradation of Cx43. We have recently identified that BubR1 regulates the phosphorylation of Cx43 at S368. Based on this finding, we hypothesize that BubR1 controls cardiac conduction through the regulation of Cx43 S368 phosphorylation. Utilizing mouse embryonic fibroblasts (MEF) cells derived from BubR1 hypomorphic (BubR1<sup>H/H</sup>) mice which ubiquitously express significantly reduced levels of BubR1, we observed that BubR1<sup>H/H</sup> MEFs had reduced phosphorylation of S368. Furthermore, using scrape loading/dye transfer (SL/DT) assay, we found BubR1 loss led to enhanced intercellular communication. We have also developed a cre-lox conditional BubR1 knockout model which allows us to specifically delete BubR1 in the heart. While homozygous cardiac-specific deletion of BubR1 in the heart is embryonic lethal, electrocardiography (ECG) demonstrates that heterozygous deletion of BubR1 in mice leads to prolonged QT interval *in vivo*. Current work is setting out to elucidate the molecular and cellular mechanisms by which BubR1 controls cardiac conduction through Connexin43.

*Chromosomal AmpC Induction by Imipenem Occurs in the Absence of the Porin, OprD*

Shawn Freed, Jr., and Nancy Hanson, Ph.D.

Department of Medical Microbiology and Immunology, Creighton University School of Medicine, Omaha, NE

**Background:** *Pseudomonas aeruginosa* (PA) is a gram-negative bacillus and opportunistic pathogen that can cause lung, bloodstream, or surgical site infections. Many PA isolates have emerged resistant to  $\beta$ -lactam antibiotic treatment due to  $\beta$ -lactamases, such as AmpC, and reduced outer membrane permeability. Sub-lethal concentrations of imipenem can induce AmpC overexpression, leading to  $\beta$ -lactam therapeutic failure. Imipenem is reported to use the outer membrane porin, OprD to enter the cell, however the related porin, OpdP, has been shown to have affinity for imipenem. The purpose of this study was to investigate the ability of imipenem to induce AmpC in PA in the absence of detectable OprD.

**Methods:** 17 clinical and 3 laboratory strains (PAO1,  $\Delta$ OprD,  $\Delta$ OpdP) were assessed for their MICs to imipenem. Isolates were induced with 1/4th the MIC of imipenem for 15 minutes following growth. RNA expression of AmpC, OprD, and OpdP was determined by rtqPCR and protein levels determined through immunoblot. Uninduced isolates were used as comparators for analysis. Whole genome sequencing (WGS) data were generated by MiSeq and evaluated.

**Results:** Imipenem MICs ranged from 4  $\mu$ g/ml to 128  $\mu$ g/ml. OprD protein was not detected (17/17) despite only 6/17 having no RNA expression (CTs 35 to 37), while 16/17 had mutations identified by WGS. OpdP expression ranged from CTs 29 to 34, yet wild-type sequence was identified for all isolates. 14/17 clinical isolates and lab strains  $\Delta$ OprD and  $\Delta$ OpdP exhibited RNA induction for AmpC (34 to 42000-fold) while protein was induced for all isolates.

**Conclusion:** Induction of AmpC in isolates lacking OprD suggests imipenem enters PA through an alternative porin. Modifying carbapenems more efficiently to utilize the conserved OpdP porin may aid in restoring susceptibility in PA. This study highlights the need to investigate porins closely related to OprD.

7

10:30 AM  
HARPER  
2045

### *Advancing Radioimmunotherapy for Brain Tumors Using In Vitro Assays*

**Yohan Walter**, Olivia Salas, Allie Benoit, Erika Jank, Destiny Jordan, Anne Hubbard, and Dr. Andrew Ekpenyong

Department of Physics, Creighton University, Omaha, NE

**Purpose:** Glioblastoma is the most common and malignant primary brain tumor. Due to factors including resistance to treatment, local invasion, and high risk of recurrence, glioblastoma patient prognoses are often dismal, with median survival around 15 months. The current standard of care consists of radiation therapy and concurrent or adjuvant chemotherapy with temozolomide (TMZ). However, patient survival has only marginally improved, sounding a call for improved therapy for glioblastoma.

More recently, triumphs using anticancer agents acting as immune-checkpoint inhibitors against cancers including metastatic melanoma and non-small-cell lung cancer (NSCLC) have garnered interest toward applying these agents to glioblastoma. One such agent, durvalumab, is undergoing phase I and II clinical trials in radioimmunotherapy for recurrent glioblastoma and high-grade glioma. However, agents showing high therapeutic potential may also carry unforeseen effects which may affect treatment outcomes. The purpose of this work is to bring these agents used in radioimmunotherapy applications to in vitro systems, where some effects may be better observed, with the goal of developing effective combination modalities for glioblastoma, which has a 5-10% 5-year survival rate.

**Methods:** Using a Faxitron CellRad cell irradiator and a commercially available Electric Cell Impedance Sensor (ECIS), we quantified cell migration following the combination of radiotherapy and chemotherapy with temozolomide (TMZ), and now focus on the combination of radiotherapy and immunotherapy with durvalumab, a PD-L1 immune checkpoint inhibitor.

**Results:** Preliminary results show that irradiated T98G and U87 MG cells (glioblastoma) migrate significantly more ( $p < 0.01$ ) than untreated cells in the first 20-40 hours posttreatment, and that the addition of temozolomide further alters cell migration and attachment. Shifting focus toward durvalumab in radioimmunotherapy, results in ECIS, cell morphometry, and clonogenic assays will be presented.

**Conclusions:** Our preliminary results suggest that ECIS and clonogenic assays can be used to explore effects of immunotherapy and radiotherapy on cell migration, aiding in the determination of effective therapeutic windows for glioblastoma while detecting changes to cell behavior.

8

10:45 AM  
HARPER  
2045

### *Ontogeny of Attention Dysfunction in Early Childhood*

**Jaylin Tuman**<sup>1</sup> and Anastasia Kerr-German<sup>2</sup>

<sup>1</sup>Department of Neuroscience, Creighton University, Omaha, NE; <sup>2</sup>Boys Town National Research Hospital, Omaha, NE

Attention-Deficit/Hyperactivity Disorder (ADHD) is highly heritable and is the most common neurodevelopmental disorder in childhood, affecting 7-11% of children with 50-60% of these cases persisting into adulthood. Early identification is imperative for optimizing the long-term impact of interventions. Visual attention processing begins in infancy and is one of the cognitive domains most interrupted in children with ADHD. However, research into the neurocognitive basis of attention in children under 5 is difficult using traditional neuroimaging methods (e.g., fMRI). Thus, identifying children who are at risk behaviorally, genetically, and neurologically is highly important and extremely difficult. The current study employed functional near-infrared spectroscopy (fNIRS) to assess the neurocognitive relationship between attention and executive functioning in children (2-5-years old, N=108, 50% female) during a Go/No-Go task, novel visual attention task, and novel working memory task. These data are the first to report an association with familial risk for ADHD along with both neurophysiological and behavioral differences in toddlers. Results suggest that ADHD risk may have tangible manifestations, beyond temperament, in children even before the typical age of diagnosis.

**MEDICAL SCHOOL PRESENTATIONS: 9:00-11:30 AM  
TUESDAY APRIL 20, 2022  
STUDENT ABSTRACTS**

**37**     *Repetitive Practice on High-Fidelity Cadaveric Model Shows Sustained Improvement of Medical Student Chest Tube Placement Times*

**Brooke McGill**<sup>1</sup>; Nichole Kaley<sup>1</sup>, Suhail Zeineddin<sup>2</sup>, Winnie A. Feng<sup>2</sup>, Peter Wu<sup>3</sup>, James Mankin<sup>2</sup>, Kayla Gray<sup>1</sup>, Kristina Chapple<sup>1</sup>, Femi Oladokun<sup>1</sup>, Carla Barrera<sup>1</sup>, Scott Echols<sup>4</sup>, Hahn Soe-Lin<sup>2</sup>, and Jordan Weinberg<sup>2</sup>

<sup>1</sup>School of Medicine, Creighton University, Omaha, NE; <sup>2</sup>Department of General Surgery, Phoenix, AZ; <sup>3</sup>Department of Surgery, Boston Medical Center, Boston, MA; & <sup>4</sup>Parrish Creek Veterinary Hospital

**Background:** Chest tube (CT) insertion is one of the core skills that surgical residents must learn. Traditional practice of this skill is on plastic mannequins, with the first CT insertion on realistic tissue happening on a live patient. We propose using donor cadavers preserved with a non-formalin solution as a method for improving trainee procedural competency without negatively impacting patient safety. These high-fidelity practice models could serve to bridge the gap between traditional practice models and live patients.

**Methods:** Four 4th-year medical students performed timed placement of bilateral CTs on a non-formalin preserved donor cadaver. Students completed three iterations of timed CT placement. Additional timed CT placements took place two weeks, two months, and four months later. CT placement times were compared to the median CT placement times of surgical interns and junior surgical residents. An attending trauma surgeon graded each CT and gave a grade of pass or fail with reason for failure documented.

**Results:** Median times for CT placement were 265, 278, 162, 190, 162, and 164 seconds ( $P=0.065$ ) over the course of each student's initial 6 attempts. Two weeks later the placement time was 150 seconds. Two months later the placement time was 138 seconds. Four months later, the median of first and second placement was 198 seconds and 158 seconds respectively.

**Discussion:** Six repetitions of the procedure on one day showed significantly improved skills and those skills were maintained over a four-month period. The use of non-formalin preserved cadavers can significantly change the way students and residents learn procedures, especially in surgical specialties where much of procedural learning has traditionally taken place on live patients out of necessity. By providing learners with a high-fidelity and longer lasting training model, we hope to simultaneously improve patient safety and increase learner confidence in high-stakes procedures.

**38**      *From Sauerkraut to Sewage: A Review of Persistent Parosmia/Phantosmia Following SARS-CoV-2 Infection and Exploration of Potential Therapies*

**Madeline Nottoli**, Julia Drexelius, and John Kirsch

School of Medicine, Creighton University, Phoenix, AZ

**Background:** Owing to the novel status of the Sars-CoV-2 virus, the extent of its long-term effects is still not fully understood, including those involving damage to the olfactory bulb. Two highly disturbing and less commonly discussed sequelae of infection are parosmia, which is defined as the incorrect perception of existing smells, and phantosmia, or olfactory hallucination. Parosmia and phantosmia can negatively affect both mental and physical health, with manifestations ranging from depression to significant weight loss.

**Methods:** A literature review was conducted to examine the prevalence of parosmia and phantosmia following COVID-19 infection, length of time to improvement, as well as the efficacy of various therapies that have been used.

**Results:** In those studies whose population were COVID+ patients, 24% reported experiencing parosmia and/or phantosmia at some point. Of the 299 patients whose duration of symptoms was documented, the majority (n=139, 64.9%) still had symptoms of parosmia and/or phantosmia 3 months or more after recovering from COVID-19. It is common for onset to be delayed from initial infection, in some rare cases up to 6 months. A wide variety of distorted smells were reported by patients, including but not limited to sewage, soap, sauerkraut, moldy socks, onion, smoke, and rotten meat. Proposed therapies such as oral and nasal steroids, as well as olfactory training, have been trialed in a limited population. In patients that underwent any of these treatments, only 7% (n=15) showed symptom improvement.

**Conclusion:** Parosmia and phantosmia are relatively common but detrimental sequelae of COVID-19 infection and may persist for months. No single therapy has emerged as an effective option, indicating the need for further work to be done in order to help restore quality of life to affected patients.

**39**      *The Use of the Fibula Free Flap for Limb Reconstruction in Pediatric Patients*

**Danielle-Aditi Raikar**, and Timothy Schaub

School of Medicine, Creighton University, Phoenix, AZ

**Objective:** The transfer of the fibula with its physis based on the anterior tibial artery as described by Innocenti in 1998 has allowed for the transport of a growing bone. Limb reconstruction offers patients a functional outcome when severely degenerative or malignant processes put the patient at risk for amputation. An important challenge to consider in the pediatric population is normal growth of long bones and how limb reconstruction can emulate this process. The purpose of this study was to analyze fibular free flaps for limb salvage in pediatric patients and demonstrate their perioperative outcomes in comparison to published outcomes.

**Methods:** We retrospectively identified 17 patients who underwent fibula free flap reconstruction of long bones and the pelvis from 2014 to 2021 at a single institution. Variables analyzed included location of limb reconstruction, indications, procedure, and complication rate.

**Results:** A total of 18 fibula free flap reconstructions were performed on 17 patients. Mean age was 8.6 years. Mean follow up time was 25 months. Etiology for reconstruction included tumor, pseudoarthrosis, and nonunion. Overall success rate was 94%, with one flap lost to infection. Complications included hematoma, arterial revision anastomosis, hardware failure revisions, and secondary procedures.

**Conclusion:** The fibula free flap is a versatile reconstruction element for limb salvage in pediatric patients that has a high success rate and allows for further growth of long bones. Our findings support published results that physicians should anticipate patients have a high success rate but also a high complication rate with secondary procedures and revisions often necessary. These findings augment the limited number of small case series in the literature and illustrate a critical but imperfect method of pediatric limb salvage.

## *Nanoparticle Delivery of Antioxidant Enzymes Protects From Ultraviolet Radiation Damage & Skin Tumorigenesis*

Patrick Kuwong, Mariam Mohagheghi, Zachary Creech, Jordyn Grewall, Gary Madsen, James A. Grunkemeyer, Poonam Sharma, and Laura A. Hansen

Department of Biomedical Sciences, Creighton University School of Medicine, Omaha, NE

**Rationale:** Skin cancer, the most pervasive cancer in the U.S, causes significant morbidity and engenders widespread economic consequences. Ultraviolet radiation (UV), a potent inducer of reactive oxygen species (ROS) and DNA lesions such as cyclo-pyrimidine dimers (CPD), 6-4 photoproducts, 8-oxo-guanine and DNA strand breaks in keratinocytes, is the main etiological factor behind skin cancer. Current sunscreens are ineffective at protecting keratinocytes from UVR's hazardous effects, thus there is need for potent drugs to complement current chemopreventive approaches.

**Hypothesis:** Topical application of Superoxide Dismutase and Catalase encapsulated in PLGA nanoparticles (PRO-NPTM) reduces UVR's genotoxic and tumorigenic potential in SKH-1 mice.

**Methods:** In dose response experiments designed to find the optimal PRO-NPTM concentration, SKH-1 mice (n=4-6), were topically treated with vehicle lotion or 0.1%, 0.2%, 0.5%, 1%, and 2% PRO-NPTM and UV-irradiated (15-18 kJ/m<sup>2</sup>, 5x/week for two weeks) or sham irradiated. For tumor initiation and promotion, SKH-1 mice (n=16), were topically treated with vehicle or 0.5% PRO-NPTM and UV-irradiated (18kJ/m<sup>2</sup>, 5x/week for 22 weeks) or were sham-irradiated. Skin tissues from all experiments were collected, fixed, and tested for different end points, including CPD, the DNA damage marker  $\gamma$ H2AX, the apoptosis marker Cleaved Caspase-3 and proliferation marker PCNA via immunofluorescence (IF). IF images were digitized using Olympus Virtual Slide Scanner, and positively stained cells per length of tissue were quantified in an automated manner. To assess PRO-NPTM's anti-tumorigenic potential, tumor incidence, tumor multiplicity, and tumor burden were monitored bi-weekly.

**Results:** Quantification of DNA damage markers ( $\gamma$ H2AX and CPD) via IF from dose response experiments revealed a significant increase in the vehicle-treated-UV irradiated (Vehicle-UV) group compared to the vehicle-treated and sham-irradiated group, as well as a significant decrease in the Pro-NPTM-treated-UV irradiated (PRO-NP UV) group compared to the vehicle-treated and sham-irradiated group. Notably, PRO-NPTM concentrations of 0.2% and above caused a 75-80% decrease in  $\gamma$ H2AX signal, while PRO-NPTM concentrations at 1% and above caused a 30-40% decrease in CPD IF signal. Similarly, quantification of CPD and  $\gamma$ H2AX IF from chronically-irradiated mice also revealed a significant difference between sham and Vehicle-UV groups, along with a significant difference between Vehicle-UV and PRO-NP UV groups. Consistent with previous experiments, 0.5% Pro-NPTM reduced  $\gamma$ H2AX and CPD IF signals by 54% and 63% respectively. Additionally, quantification of UV-induced proliferation via PCNA IF indicated a 40% decrease in PRO-NPTM treated and UV-irradiated mice compared to the vehicle-UV mice. Lastly, tumor multiplicity data from chronically irradiated mice also revealed that 0.5% PRO-NPTM reduced UV-induced tumor formation by 61% at week 18, and 40% at week 22.

**Conclusion:** Nanoparticle-mediated delivery of superoxide dismutase and catalase to basal keratinocytes reduces UV-induced DNA damage in keratinocytes and suppressed tumorigenesis in SKH-1 mice.

### *Optimizing Patient Accessibility: Patients with Decreased Vision Prefer Educational Materials in Alternative Media Formats*

**Garrett Manion**<sup>1</sup>, Michael Pascoe<sup>2</sup>, Shahzad Mian<sup>3</sup>, Thomas J. Wubben, Anjali Shah, Grant Comer, Tannen Bradford, Nambi Nallasamy, Christopher Hood, Lesley Everett, and Benjamin Young

<sup>1</sup>Creighton University School of Medicine, Omaha, NE; <sup>2</sup>Central Michigan University, Mount Pleasant, MI; <sup>3</sup>W.K. Kellogg Eye Center, Ann Arbor, MI;

**Purpose:** Written materials are the dominant medium to convey educational and instructional information to patients. Given the significant proportion of patients with visual impairment in ophthalmology clinics, we hypothesize that these patients would prefer information presented through alternative media formats.

**Methods:** Patients were recruited from the University of Michigan Kellogg Eye Center Retina clinics (n=60) who had low vision, were scheduled for retina surgery or their first intravitreal injection, or were from the cornea clinic (n=50) at their pre-operative cataract surgery appointment. Best corrected visual acuity (BCVA), age, gender, electronic device usage, and usage of written materials were collected. Each patient completed Likert scale questionnaires to evaluate preference for written, infographic, audio, and video mediums of education. Data were analyzed through two-tailed Student's t-test. An institutional review board reviewed this study protocol.

**Results:** Patients with BCVA of 20/50 or worse comprised 50% of the retina clinic and 30% of the cornea clinic participants. Their most preferred medium was audio while least preferred was written. Lower visual acuity positively correlated with preference for audio ( $p<0.001$ ) and video ( $p<0.001$ ) mediums while negatively correlating with written ( $p=0.0004$ ) and infographic ( $p=0.0024$ ) mediums. Patients with lower visual acuity were also less likely to use written handouts from any physician at prior encounters ( $p<0.001$ ). For all patients, video was most preferred and audio least preferred. In patients with BCVA 20/40 or better, written was the most preferred medium.

**Conclusion:** Patients with visual impairment tend to not use written materials from physicians and prefer alternate mediums of receiving information. Low visual acuity was associated with preference for audio and video over written and infographic mediums, with audio being most preferred. The patient population as a whole preferred video. Further investigation will be needed to see if these mediums are effective for educating visually impaired patients. Physicians may consider investing in alternative educational methods to increase accessibility of information to their patients.

### *Getting to the Bottom of Human Trafficking Vulnerability: Domestic Minor Human Trafficking Among Racial/Ethnic Minority Youth and Youth with Disabilities*

**Claire Willman, Claire;** Blanchard Bekmuratova, and P. Peitzmeier

Creighton University School of Medicine, Omaha, NE

**Background:** While current literature suggests that youth who are homeless, runaways, and a sexual minority are at risk for human trafficking (HT), not much is known about other youth who are vulnerable to HT victimization. Little is known about the incidence of youth from racial/ethnic minority backgrounds and those with disabilities who are at elevated risk to become a HT victim. This study aimed to identify micro level risk factors and protective factors among these vulnerable youth for HT.

**Methods:** Qualitative data was collected through key informant interviews with local community organizations in Nebraska. We used convenience and snowball sampling to recruit participants. Twenty-two semi-structured interviews were conducted via Zoom lasting about 60 minutes from September to December 2020. The interviews were audio-recorded and transcribed verbatim. Inductive content analysis was used to analyze qualitative data.

**Results:** One central and five major themes for micro-level risk factors emerged from the qualitative data. Major themes included a) poverty, b) unsafe home environment, c) lack of template for healthy relationship at home, d) race, and e) disability status of youth. "The need of youth for love and support not being met" emerged as the central theme for vulnerability of these youth for HT. We also identified protective factors that included three themes such as a) strong relationship/support with adult or peer group, b) relapsing to HT as part of healing journey, and c) creating environment for healing trauma and finding purpose. The study findings have significant implications for HT program and intervention development, policy development, and future research.

### *Flower Isoforms of Cutaneous Squamous Cell Carcinoma Cells Resist Differentiation*

**Colleen Glennon,** Justin C. Rudd, Rachel Johnson, Thien Tran, James A. Grunkemeyer, and Laura A. Hansen

Department of Biomedical Sciences, Creighton University School of Medicine, Omaha, NE

Skin cancer is the most common cancer worldwide, and cutaneous squamous cell carcinoma (cSCC) represents 20-50% of all nonmelanoma forms of skin cancer. While many cases of cSCC are successfully treated with surgical excision, a subset of cSCC possess more aggressive features. The role of cell competition through transmembrane Flower (hFWE) protein signaling in the formation of cancerous cell populations has been recently reported. These Flower proteins have been identified as "fitness fingerprints" of various epithelial cells, and certain "winning fingerprints" demonstrate a competitive advantage when near "losing fingerprint" cell populations. Our laboratory is investigating the role of Flower proteins in cSCC. While four distinct human isoforms of Flower, hFWE1/2/3/4, are produced by alternative splicing, we found that hFWE3 and hFWE4 are the predominant isoforms present in skin and in cSCC conducted analysis by using publicly available RNA-sequencing data. In vitro experiments have demonstrated that in cSCC cells, the hFWE3 isoform marks "winners" during competition, and that these "winners" force non-autonomous delamination of neighboring wild type (WT) "loser" cells. Here, we demonstrate that while hFWE3 positive keratinocytes did not out-expand wild type keratinocytes in vivo, they were strikingly overrepresented in the basal tumor cell population, relative to the proportion of the tumor that they composed, compared to WT-EGFP, hFWE2 and hFWE4 overexpressing cells. In all xenograft groups, WT-DsRed2 cells predominated with an average area proportion of 50%, compared to an average area proportion of 20% for both WT-EGFP and hFWE-EGFP populations. While the loss of EGFP+ cells across all coculture groups likely indicates a competitive disadvantage conferred by EGFP expression in vivo, our K10/hFWE double immunofluorescence experiments demonstrate that hFWE3 overexpressing cSCC cells are more effectively able to compete for residence in the basal tumor cell population compared to hFWE2 ( $p=0.0113$ ,  $N=4$ ) and to hFWE4 ( $p=0.0016$ ,  $N=4$ ) overexpressing cells.

**44**      *Flower Isoforms of Cutaneous Squamous Cell Carcinoma Cells Resist Differentiation*  
**Ross Johnson**, Abdulbaril Olagunju, Ali Moradi, Benjamin Johnson, and Azar Mehdizadeh

Department of Cardiovascular Diseases, Creighton University School of Medicine, Phoenix, AZ

Viral infections are a common cause of acute myocarditis. However, vaccines including influenza and smallpox have also been rarely implicated. Recently, the Coronavirus Disease 2019 (COVID-19) vaccines have been associated with acute myocarditis. We describe a case of acute myocarditis in a 19-year-old male 2 days after the initial dose of the COVID-19 mRNA-1273 vaccine. He presented with chest pain radiating to his left arm and bilateral shoulders. COVID, Influenza, Coxsackie, Respiratory Syncytial Virus PCR tests were negative. Electrocardiogram revealed diffuse ST-segment elevation. Initial Troponin was 15.7ng/ml. A coronary angiogram revealed patent coronary arteries and no wall motion abnormality. A transthoracic echocardiogram showed diffuse hypokinesis with an ejection fraction of 49%. Cardiac magnetic resonance scan was aborted after two attempts due to severe claustrophobia. His chest pain resolved following initiation of Aspirin, Tylenol, Colchicine, Lisinopril and Metoprolol. A significant number of COVID-19 vaccine-associated myocarditis cases have been described in the young adult population between ages 16 to 30, most of whom had no significant morbidities. Male patients have been predominantly affected, mostly after receiving the second dose of the mRNA vaccine, with a reported incidence of 5.8 cases per million after second doses compared to 0.8 per million after the first dose. Notably, there is no substantial evidence proving a direct causal effect between COVID-19 vaccination and acute myocarditis. Therefore, the very rare association of vaccination with myocarditis should not preclude vaccination as the benefits exceedingly outweigh the risks.

**45**      *Charting Trends in Medicare Reimbursement for Lower Extremity Imaging*  
**Zachary LeBaron**, Evan H. Richman, Parker J. Brown, Ian D. Minzer, Joseph C. Brinkman, Nathaniel Hinckley, Michael G. Fox, and Karen Patel

Creighton University School of Medicine, Phoenix, AZ

**Objective:** To evaluate Medicare reimbursement trends for the 20 most common lower extremity imaging studies performed between 2005-2020.

**Methods:** The Physician Fee Schedule Look-Up Tool from the Centers for Medicare and Medicaid Services was analyzed for reimbursement rates and Relative Value Units (RVUs) associated with the top 20 most utilized Current Procedural Terminology (CPT) codes in lower extremity imaging from 2005-2020. Reimbursement rates were adjusted for inflation and listed in 2020 US dollars using the US Consumer Price Index. To compare year-to-year changes, the percent change per year and compound annual growth rate (CAGR) were calculated.

**Results:** After adjusting for inflation, average reimbursement for all procedures decreased by 32.41%. Average adjusted percent change per year was -2.82% and average CAGR was -1.03%. Compensation for the professional and technical components for all CPT codes decreased by 33.02% and 85.78%, respectively. Average compensation for the professional component decreased by 36.46% for X-ray, 37.02% for CT, and 24.73% for MRI. Average compensation for the technical component decreased by 7.76% for X-ray, 127.66% for CT, and 207.88% for MRI. Average total RVUs decreased by 38.7%.

**Conclusion:** Medicare reimbursement for the most billed lower extremity imaging studies decreased by 32.41% between 2005 and 2020. The greatest decreases were noted in the technical component. Of the modalities, MRI saw the largest decrease, followed by CT, and then X-ray. This study adds to the collective data on Medicare reimbursement trends, allowing for more accurate discussions of future Medicare changes.

### *Palliative Care Patterns in Anaplastic Thyroid Carcinoma: An Analysis of the National Cancer Database*

**Michelle Swedek**, Xinxin Wu, Julia Griffin, Timothy Malouff, and Peter Silberstein

Creighton University School of Medicine, Omaha, NE

**Background:** Anaplastic thyroid carcinoma (ATC) is an aggressive neoplasm accounting for significant morbidity and mortality amongst thyroid carcinomas. Palliative care (PC) includes therapies focused on improving the quality of life in patients with serious diseases. There has yet to be a study describing the demographic and usage factors associated with PC in ATC.

**Methods:** We conducted a retrospective study using the 2018 National Cancer Database (NCDB) for subjects with undifferentiated, anaplastic, or pleomorphic carcinoma at the thyroid (n=3236). Analysis was completed for PC patients (n=534) versus non-PC patients (n=2702). The NCDB defines palliative care as care provided to alleviate or palliate symptoms, including radiation therapy, surgery, pain management, and/or systemic therapy. Demographic factors were analyzed using Pearson chi-squared tests and t-tests, while survival was estimated using Kaplan-Meier curves.

**Results:** The study population was predominantly white (87.2%) and female (58.5%). The mean age at diagnosis was 70.71 years old. Most subjects were treated at an academic/research program (46.0%) or Comprehensive Community Cancer Program (31.5%). Many subjects had an annual income below \$63,000 (68.0%), and 17.9% of subjects lived in an area where at least 21.0% of individuals had not graduated high school. Just 16.5% of subjects received PC. PC was more frequently used in 2017 (11.6%) compared to 2004 (3.6%). Patients were less likely to receive PC if they had a median household income above \$63,000 (p=0.011), or if they used private insurance (p=0.013). Individuals at an academic/research program or integrated network cancer program were more likely to receive PC (p=0.042). The median survival time was 2.43 months for PC patients and 3.94 months for non-PC patients (p<0.001).

**Conclusion:** We identified demographic trends associated with PC use. Significant factors included facility type, income, insurance status, urban/rural setting, year of diagnosis, and survival. This study is a valuable baseline as PC is integrated into cancer care.

### *Eclampsia Complicated by Subarachnoid Hemorrhage in the Context of Posterior Reversible Encephalopathy and COVID-19 Infection*

**Pooja Kasinath**, Elise Tidwell, Meaghan Shanahan, and Margaret Beran

Department of Obstetrics & Gynecology, Creighton University School of Medicine, Omaha, NE

Posterior reversible encephalopathy syndrome (PRES) is a neurotoxic condition that can present with seizures, headaches, and radiologic findings of vasogenic edema. Eclampsia and pre-eclampsia can predispose patients to developing PRES in the setting of endothelial dysfunction that could be caused by covid-19, or another vasogenic mechanism. It is not well understood how covid-19 can affect the brain but there is evidence that it can cause neurological symptoms. Covid-19 has been implicated in the pathogenesis of eclampsia, PRES and subarachnoid hemorrhage (SAH). PRES has been implicated in the pathogenesis of SAH and eclampsia. However, eclampsia is not well connected to the presence of SAH. In our case, a 33-year-old multiparous woman presented to the hospital and was admitted for supervision of labor complicated by covid-19 infection and anemia. She delivered a healthy infant. She proceeded to have severe range blood pressures after delivery, and experienced multiple tonic-clonic seizures that were controlled with magnesium sulfate, labetalol and nifedipine. At this time, she had radiological evidence of SAH and PRES. Our patient had a SAH in the context of PRES, eclampsia, and a covid-19 infection. Her SAH could be due to the vasogenic edema from PRES that could have been triggered by endothelial damage from covid-19, and vasogenic dysfunction from eclamptic seizures

**48**      *Granulomatous Cheilitis in Children: Three Cases Successfully Treated with Intralesional Corticosteroids*

**Graison Sitenga**, Peter Granger, and Tyler Bendrick

Creighton University School of Medicine, Phoenix, AZ

Granulomatous cheilitis (GC) is a chronic inflammatory disorder characterized by continuous or episodic non-caseating granulomatous enlargement of the lip and/or labial commissures. It may present as an idiopathic dermatologic lesion or as an associated finding in Crohn's disease, sarcoidosis, orofacial granulomatosis, and Melkersson-Rosenthal syndrome (1, 2). Pediatric cases of GC have historically been difficult to manage effectively with traditional treatment methods, including oral and topical corticosteroids, and cases often result in unreliable treatment outcomes (1, 2, 3). Since its first use in 1992, intralesional injection of triamcinolone has demonstrated efficacy in improving GC in adult patients, demonstrating positive therapeutic outcomes, fewer treatment complications, and effective symptom management (1, 3, 4, 5). While intralesional treatment of GC has shown efficacy in adult populations, fewer clinical examples of intralesional corticosteroid management of GC in children exist to date (2, 3, 4). To examine the efficacy of intralesional triamcinolone in pediatric GC, Mayo Clinic Rochester medical records were reviewed for pediatric patients aged 0-18 years diagnosed with biopsy-proven granulomatous cheilitis. Results yielded three cases of idiopathic GC in children ages 4, 5, and 13 treated with intralesional triamcinolone. Intralesional corticosteroid injections provided effective treatment of GC in these three cases and provided quick and effective improvements in both patient symptoms and appearance. Although single-dose treatment was not curative, lip swelling and disease progression decreased significantly for at least several months in all of our patients, with continued control with additional subsequent injections as needed. Procedural pain may be managed with ice and topical anesthetics in the appropriate clinical setting versus general anesthesia based on patient factors. While idiopathic GC is commonly diagnosed initially as an isolated finding, a strong degree of suspicion should be maintained for the development of Crohn's disease and other systemic conditions.

**49**      *The Use of Flutamide for the Neoadjuvant Treatment of Juvenile Nasopharyngeal Angiofibroma: A Review of the Literature Comparing Results by Pubertal Status and Tumor Age*

**Peter Granger**, Graison Sitenga, Keiffer Hepola, Jenna Aird, and Peter Silberstein

Creighton University School of Medicine, Omaha, NE

Juvenile nasopharyngeal angiofibroma (JNA) is a rare but potentially life threatening fibrovascular tumor that is seen almost exclusively in adolescent males and usually presents with symptoms of nasal obstruction or severe epistaxis. The current gold standard of treatment consists of complete surgical resection; however, this is inherently challenging due to the tumor's invasive nature and a substantial risk of intraoperative hemorrhage. Flutamide, an anti-androgen antineoplastic agent, has been used preoperatively in attempts to reduce tumor volume allowing for surgical resection with more conservative procedural techniques and reduce intraoperative blood loss. A literature review of PubMed and CINAHL were used to identify and analyze 29 male patients with JNA to determine the efficacy of the pre-operative use of flutamide. Our analyses indicate that flutamide may be effective as a neoadjuvant agent by reducing tumor volume prior to resection in some patients but seemed to be more effective in the early stages of JNA without advanced tumor invasion. However, individual tumor response to flutamide was variable. Additionally, postpubertal patients seemed to demonstrate a greater reduction in tumor volume with flutamide compared to their prepubertal counterparts. Dosing regimen and side effects associated with flutamide therapy are also discussed. Flutamide may be an effective neoadjuvant therapy in some cases of juvenile nasopharyngeal angiofibroma, but larger scale, case-control studies are likely needed to further expand on this conclusion. Postpubertal males with early-stage disease seemed to be the population that may benefit most from this treatment protocol.

**50**      *Eosinophilic Fasciitis in a Pediatric Female Patient: A Case Report*

**Tiffany Chu**, and Estefania Quesada-Masachs

Creighton University School of Medicine, Omaha, NE

Eosinophilic fasciitis (EF) is a rare scleroderma-like disorder characterized by inflammation and thickening of the skin which can present with erythema and venous grooving. This idiopathic disorder was first reported by Shulman in 1974 (1) and later termed by Rodnan et al. who described aggregation of eosinophils in the fascia (2). To our knowledge, only a few pediatric cases have been reported in the literature (3). Here we report the case of an 8-year-old female patient who presented with classic cutaneous symptoms of EF – skin thickening and bilateral induration of extremities (sparing the fingers and distal areas) that progressed to painful bilateral joint contractures. Serum eosinophilia, bilateral thickening of the muscular fascia (MRI), and inflammatory infiltrate with abundant eosinophils of the fascia (biopsy) were confirmed. Treatment with methotrexate and high doses of glucocorticoids were initiated. The patient had a good clinical response but was intolerant to standard high dose glucocorticoids, and the disease recurred upon every attempt of glucocorticosteroid tapering. Tacrolimus was subsequently added, with good clinical response. After 6 months of therapy with methotrexate, tacrolimus, and low dose prednisone, she developed bilateral symmetrical morphea on the dorsal feet (confirmed by skin biopsy and treated topically). Currently, the patient is out of treatment and in clinical remission. Although EF may initially present with mild manifestations, this autoimmune disease can significantly progress, decrease a patient's quality of life and cause permanent damage. Therefore, it is crucial that it be diagnosed early and treated aggressively to prevent more severe and permanent complications.

**51**      *COVID-19 Infection and Baricitinib Treatment Associated with Arterial Thrombosis: A Case Report*

**Sarah Eversman**, Kishan Srikanth, Arjun Vadlamudi, and Joseph Thirumalareddy

Creighton University School of Medicine, Omaha, NE

**Introduction:** Baricitinib is a janus kinase (JAK) inhibitor that preferentially inhibits JAK-1 and JAK-2 and is known to have anti-inflammatory properties. It is an approved treatment for hospitalized COVID-19 patients and is associated with a statistically significant reduction in mortality. Coagulopathy is a known sequela of COVID-19 infection, and JAK inhibitors have also been associated with an increased risk of thrombus formation.

**Case Presentation:** A 69-year-old female presented to the emergency department after testing positive for COVID-19. Evaluation revealed typical COVID-19 pneumonia with associated acute hypoxic respiratory failure requiring supplemental oxygen. The patient was unvaccinated against COVID-19. She was admitted to the hospital and started on COVID-19 protocol including dexamethasone, remdesivir, and daily diuresis with IV furosemide. She was also started on enoxaparin for deep vein thrombosis prophylaxis. Due to continued disease progression, she qualified to start baricitinib treatment. Five days after starting baricitinib, the patient was noted to have left lower extremity (LLE) numbness and pallor. CT angiography of the LLE showed 90% occlusion of the left common iliac artery. Enoxaparin was discontinued and the patient was started on a high-dose heparin drip, aspirin, and clopidogrel. LLE angiogram with placement of a left iliac stent was performed and baricitinib was discontinued. The patient subsequently had a complicated hospital stay, and unfortunately died 20 days after testing positive for COVID-19.

**Discussion:** It is possible the addition of baricitinib could have played a role in the development of this patient's arterial clot. This patient's case suggests that it could be important to consider cardiovascular risk factors in combination with the hypercoagulable state caused by COVID-19 when initiating baricitinib therapy in specific hospitalized patients

## 52 *Utilization of Color-coded Digital Three-dimensional Models in Anatomy Education*

Eugene Moon, and Hector Chong

Creighton University School of Medicine, Phoenix, AZ

**Background:** In recent years, there has been an increase in the utilization of digital software tools in medical education, in particular, three-dimensional (3D) modeling. Our proposed study aims to evaluate the efficacy of a standardized color-coded protocol for digital 3D models generated from computer tomography (CT) scan images. This protocol seeks to leverage the human brain's ability to differentiate color to improve identification and facilitate faster recall of structures in normal and abnormal cardiac anatomy.

**Methods:** Advantage Workstation software was used to generate digital 3D models of normal and abnormal cardiac structures from (CT) scan images. Each digital 3D model was color-coded using MIMICS 3D software based on the protocol developed by Ralhan et al. at St. Joseph's Hospital and Medical Center. The protocol used a spectrum of red hues for vessels carrying oxygenated blood (i.e. red aorta and pink left atrium) and blue hues for vessels carrying deoxygenated blood (i.e. dark blue pulmonary arteries and turquoise right atrium). Abnormal structures were highlighted in green hues.

**Future Direction:** We will conduct a timed survey in first-year and third-year medical students to identify cardiac structures on colorless and randomly-colored digital 3D models. The protocol will then be provided to students for memorization and students will be asked to identify the structures on the digital 3D models. Students will be timed from the moment they are able to visualize the digital 3D models to when they have completed identification of the cardiac structures, regardless of accuracy.

**Conclusion:** With the rise of 3D rendering, this protocol outlining the process for color-coding digital models will help students identify cardiac structures and provide a framework for 3D printed models in the future.

## 53 *Active Surveillance of Ticks and Tick-Borne Pathogens in the Omaha Metro*

Sam A. Shea, Shane M. Fleming, and Travis J. Bourret

Creighton University School of Medicine, Omaha, NE

**Background:** As the geographic distribution of ticks continues to expand across the United States, so too does the prevalence of tick-borne diseases. Of these, Lyme disease is the most common, with much attention given to its vector the deer tick, *Ixodes scapularis*. However, the most common ticks found in Nebraska include *Dermacentor variabilis* (dog tick) and *Amblyomma americanum* (Lone Star), both capable of transmitting pathogenic bacteria.

**Significance:** There are significant gaps in information on local distribution of tick vectors. Mapping and understanding the local distribution of tick vectors will help predict where populations are at risk. Proposed hypothesis, we expect to identify the tick species *D. variabilis* and *A. americanum* and all life stages of *I. scapularis*.

**Experimental Design:** Collection of ticks began in May 2020 from State Parks near Omaha. Ticks were collected by dragging a linen cloth along hiking trails. Ticks were tested for the presence of pathogens by PCR, and positive results were submitted for Sanger sequencing for confirmation.

**Results:** In total, we collected 196 ticks. The only two tick species found were *D. variabilis* and *A. americanum*. We did not find *I. scapularis*. Results are ongoing. Thus far, we have analyzed 72 of the 196 total ticks. 60% were positive for *Ehrlichia spp.*, but none for *E. chaffeensis* (causative agent of Human Monocytic Ehrlichiosis). Of the 72 ticks tested thus far, 11 were *A. americanum*. Of these, 4 tested positive for the bacterium *Rickettsia rickettsii*, the causative agent of Rocky Mountain spotted fever.

**Conclusion:** While not finding *I. scapularis* is ultimately good news, a sample size of 183 is too small to make definitive conclusions regarding its presence. In regard to the ticks that tested positive for *Ehrlichia* species, it is likely that these are endosymbiotic *Ehrlichia* species that pose no threat to humans.

## **54**      *Scope of Practice and Length of Service as Clerkship Director on Residency Recommendation Requests*

**Charissa Lau**, Dorothy Kenny, and Jeffrey Curtis

Creighton University School of Medicine, Phoenix, AZ

The number of medical students pursuing primary care has decreased over time despite increases in medical school enrollment. Institution factors correlated with higher match rates include longer duration of the family medicine clerkship, smaller annual clerkship enrollment, and having at least 1 family medicine faculty in senior leadership. Match rates are also positively correlated with family medicine clerkships offering more comprehensive clinical services, indicating that scope of practice in clerkships likely impacts students applying for residency. Data suggests that declining scope of practice and resources negatively impacts the quantity and quality of medical students entering family medicine residencies. We completed a secondary analysis of the 2014 CERA Family Medicine Clerkship Director Survey to determine if a program's scope of practice and the Clerkship Director's (CD) length of service were correlated with medical students asking for opinions regarding other residency programs. Scope of practice was measured using the scope of practice index (SPI) defined by a prior analysis. 125 academic family physicians responded to the survey, of whom 105 provided full data on the variables assessed and are included here. Our study demonstrated no association between scope of practice or CD length of service on the extent to which medical students asked the CD's opinion about residencies. Our findings were unexpected as prior research indicates students value family medicine clerkships and residencies with a greater scope of practice. However, evidence also suggests that CD's play a significant advisory role in career planning with students, regardless of a program's scope of practice. Further examination may reveal other factors that determine whether a student seeks guidance from a CD. Future directions could include surveying specific details students request regarding residencies as well as what features are associated with students not approaching the CD for recommendations, and whether this differs among different programs.

**55**      *Nanoscale Peptide Assemblies and Formulations for Multifunctional Otological Drug Delivery*

**Swapnil Shah**, Evan Patel, Christopher Fry, and Ashok Jagasia

Creighton University School of Medicine, Omaha, NE

**Introduction:** We propose the deployment of a dynamic nanoparticle assembly in the treatment of otitis media (OM). Using a dynamic transition mechanism converting between fibers and micelles, we sought to topically deliver the antibiotic Ciprofloxacin across the tympanic membrane (TM) thereby reducing the need for surgical intervention.

**Methods:** The peptide c16-AHL3K3-CO<sub>2</sub>H (PA), synthesized for this study, is able to form a hydrogel and transition from fibers to micelles. In vitro studies utilized multiwell micropore plates to determine the rate of drug delivery across the membrane when compared to Ciprofloxacin alone or in the presence of a known chemical permeation enhancer (CPE). Human Epidermal Keratinocytes (HEKA) were used to test the efficacy of cell permeation. The first study observed the effects of varying concentrations of peptide fibers in the presence of the HEKA cells. We assessed how manipulation of the peptide fibers into a micellar organization would alter permeation. Lastly, we observed how the addition of Ciprofloxacin would influence transport into the HEKA cell line. Specifically, experimental groups included the synthesized peptide fiber in conjunction with Ciprofloxacin, peptide fiber/Ciprofloxacin/SDS, Ciprofloxacin alone, and Ciprofloxacin with SDS.

**Results:** The peptide-amphiphile behaved as an “all-in-one” material, serving as a drug delivery matrix when assembled as a hydrogel and as a CPE as the peptide dissociated from the hydrogel assembly. Transfer of the peptide and drug delivery across a synthetic membrane was notably slower in fibers than in micelles. This showcases the potential application in temporally controlled drug-delivery. The capabilities of the PA to behave as a CPE was noted when the peptide interfaced with HEKA cells during its integration into the lipid membrane.

**Conclusion:** Future work will look into administering the peptide hydrogel/Ciprofloxacin solution in an in vivo animal model to determine the depth of penetration into the TM as well as the efficacy of trans-tympanic drug-delivery.

**56**      *Special Behavioral Plans and Outcomes in an Involuntary Psychiatric Hospital Setting*

**Dillon Polito**, and Gwen Levitt

Creighton University School of Medicine, Phoenix, AZ

This study is designed to identify the outcomes of the implementation of Special Behavioral Plans (SBP) on the inpatient psychiatric units at Valleywise Health System Behavioral Health. SBPs are requested by attending psychiatrists and/or nursing staff to address patients’ behavioral issues that are consistently disrupting the therapeutic milieu, dangerous, or negatively impacting the patients’ treatment and/or discharge. There are two commonly utilized SBPs. The first type of plan is referred to as a Level System and is typically implemented for patients with significant self-destructive or aggressive and violent behaviors. The second type of SBP is a reward system. The rewards are individualized for each patient to provide incentive to display appropriate behaviors. This study will retrospectively review the records of patients placed on SBPs to gather data on the type of SBP initiated, implementation of the SBP, outcome of the SBP, and success in the SBP in decreasing the target behaviors.

**57**      *Case Series of Incomplete Double Aortic Arches Diagnosed by CT Angiogram*

**Dillon Polito**, Tyler Benedrick, Sitenga Graison, Randy Richardson, and Deepa Prasad

Department of Pediatric Radiology, Creighton University School of Medicine, Phoenix, AZ

Double aortic arch (DAA) with ligamentous atresia (LA) of the left aortic arch distal to left subclavian artery (LSCA) is a rare form of complete vascular ring, which can be easily confused with right aortic arch with mirror image branching (RAMI) on transthoracic echocardiography. CT angiogram (CTA) with 3D reconstruction has become the modality of choice for accurate diagnosis of various forms of double aortic arch because of rapid acquisition and it can be performed without sedation in any age group including neonates. It provides excellent visualization of the aortic arch and its branching pattern for accurate diagnosis and surgical planning. We present a case series of this rare vascular ring in 6 pediatric patients and their outcomes.

**58**      *Geographic and Financial Trends in the Utilization of Deep Brain Stimulation in the Medicare Population from 2013-2019*

**Thomas Gossard**, Aditya Khurana, Justine Chan, and Sana Aslam

**Background:** Research studies are exploring deep brain stimulation as a treatment in over 50 different disorders involving 31 distinct brain targets.<sup>1</sup> From 1993 to 2006, majority of cases in the United States were done in large metropolitan areas at large academic centers, and estimated that 4200 DBS procedures were performed in 2006.

**Methods:** The CMS POSPUF Database (Medicare Part B Claims) was utilized, available from 2013-2019, and DBS procedural data was gathered using CPT codes 61863 and 61867. Outcomes of interest for this study included total sum of DBS procedures, average procedures volume, procedures per 100K people, and average standardized reimbursed charge by Medicare. Data was stratified by the 4 U.S. regions as determined by the U.S. Census Bureau.

**Results:** Nationally, there were 1564 procedures performed by 79 providers in 2013 and 1527 performed by 75 providers in 2019 with no significant difference in annual change in regions. The number of DBS procedures per 100K beneficiaries was consistent across all years 2013 to 2019. The number of providers performing DBS per 1 million beneficiaries was also consistent across all years 2013 to 2019. After adjusting all dollars for 2019 values, the average standardized payment amount by Medicare decreased from \$1795.62 in 2013 to \$1670.59 in 2019, resulting in a CAGR of -1.03%. Regionally, the West had the largest decrease in CAGR (-5.63%; \$1755.35 to \$1170.17), followed by the Northeast (-1.43%; \$2019.11 to \$1825.35) and the Midwest (-0.51%; \$1861.01 to \$1795.20). The South had the only increase in CAGR (+1.19%; \$1719.01 to \$1868.05). No significant difference in 2013 but significant difference in 2019, with West having the lowest amount.

**59**      *Insurance Status and Its Effect on Outcomes in Advanced Stage Primary Bone Tumors: A National Cancer Database Review*

**Vincent Eaton**, Kishan Srikanth, Kevin McMahon, and Peter Silberstein

Creighton University School of Medicine, Omaha, NE

**Introduction:** Primary bone tumors encompass a breadth of diagnoses, with the top three being osteosarcoma, Ewing sarcoma, and chondrosarcoma. Reports by the National Cancer Institute have shown that age-adjusted rates of primary bone cancers increased 0.4% annually from 2009 to 2018 with age-adjusted death rates increasing 1.6% annually during this period. This study investigates the effect of insurance status on patient survival in patients with primary bone tumors.

**Methods:** 24,532 patients with primary bone sarcomas were identified in the NCDB between 2004-2018. Patients were grouped into three cohorts: all stages (0 - 4), early stage (0 or 1), and advanced stage (4). Patients' insurance status was categorized as: no insurance, private insurance, Medicaid, Medicare, other government insurance, or unknown. Between-insurance survival differences were estimated by the Kaplan-Meier method and associated log-rank tests; Bonferroni adjusted  $p < 0.008$

indicated statistical significance. Median survival was used to assess outcomes and mean survival was used when median was unavailable.

**Results:** Medicare patient survival was statistically significantly different ( $p < 0.001$ ) when compared to other insurance types across groups. Medicare patients had the lowest survival across groups (41.3, 100.86, and 5.82 months, respectively) while privately insured patients showed the highest survival across groups (133.7, 160.4, and 64.7 months, respectively).

**Conclusion:** Increased survival in privately insured patients and decreased survival in Medicare patients were found, showing socioeconomic status' potential impact on survival in these patients. Providers should take into account all factors of a patient's situation to better treat those facing additional barriers to care due to socioeconomic factors.

## 60

### *Copeptin as a Prognostic Biomarker in Pediatric Patients*

**Julia Biagini**, and Jane Driano

Creighton University School of Medicine, Phoenix, AZ

Copeptin, the C terminus byproduct of arginine vasopressin (AVP), holds diagnostic and prognostic promise in a variety of conditions such as osmoregulatory disorders, critical illness, and perinatal illness. AVP and consequently copeptin are secreted in response to elevated serum osmolality, low blood pressure, and stress. Recently, copeptin has been proposed to be a prognostic biomarker in adult traumatic brain injury (TBI) patients in the emergency department (Choi 2017). Limited data exists on the role of copeptin in predicting outcomes in pediatric TBI patients. The purpose of this literature review is to summarize the current studies on the value of copeptin as a predictor of morbidity and mortality in pediatric TBI patients. Studies with pediatric patients were reviewed. Using copeptin drawn on different hospital days, they each established the role of copeptin as a potential biomarker for prognostication. C. Lin *et al* demonstrated elevated plasma copeptin level has a high predictive value for 6-month clinical outcomes in their patients. L. Lin *et al* and Dong *et al* both showed an association between elevated copeptin and mortality after TBI in children. Based on the limited data that exists, copeptin levels in pediatric patients with head traumas could serve as a prognostication tool. Further studies confirming these findings and establishing copeptin reference ranges in pediatric TBI patients is needed to better predict outcomes and optimize treatment.

61

### *Assessment of Biological Age Verse Chronological Age During the Care of Geriatric Trauma Patients in a Hospital with ACS's Geriatric Surgery Verification*

**Morgan Hopp**, and Alexandra Hollingworth

Creighton University School of Medicine, Phoenix, AZ

The American College of Surgeons created the Geriatric Surgery Verification program to directly improve patient care and surgical outcomes for geriatric surgical patients. Patients qualify for geriatric care based on their chronological age. As a result, many patients with comorbidities and/or life-style risks, which increase their biological age, are excluded from geriatric care services because they are not chronologically 65 years old. In contrast to chronological age, biological age assesses the age a patient considering both date of birth along with health and life-style conditions which may accelerated the aging process. The fundamental goal is to find a formulaic tool assessing the most predictive variables of biological age, therefore allowing a more comprehensive understanding of a trauma patient's health status. The initial aim is to identify variables which significantly increase biological age over chronological age as evaluated by the lengthen of stay and complication rate on comparisons of trauma patients at ValleyWise Hospital within both their peer and geriatric age groups. Identification of these variables upon retrospective chart review will demonstrate the need for more accurate evaluation and care of trauma patients upon presentation and during care. The second aim of the project address the application of these indicators of increased biological age. We expect to formulate the implicated variables into a weighted bedside assessment of biological age. Currently, Valleywise Health Medical Center is currently in the commitment level of the Geriatric Surgery Verification which provides additional care services for the geriatric patients (65 years old or older) they serve. Utilizing the patient's biological age will more accurately expands geriatric services to patients whose overall health outcomes could be bettered by the enhance care specific to the needs of an elderly body.

62

### *EMG Activity with Use of a Hands-Free Single Crutch Versus a Knee Scooter*

**Cuyler Dewar**, Terry L. Grindstaff, Brooke Farmer, Morgan Sainsbury, Sam Gay, Weston Kroes, and Kevin D. Martin

Creighton University School of Medicine, Omaha, NE

**Background:** Foot and ankle injuries frequently require a period of non-weightbearing, resulting in muscle atrophy. Our previous study compared a hands-free single crutch (HFSC) to standard axillary crutches and found increased muscle recruitment and intensity while using the HFSC. Knee scooters are another commonly prescribed non-weightbearing device. The purpose of this study is to examine the electromyographic (EMG) differences between a HFSC and knee scooter, in conjunction with device preference and perceived exertion.

**Methods:** A randomized crossover study was performed using 30 non-injured young adults. Wireless surface EMG electrodes were placed on the rectus femoris (RF), vastus lateralis (VL), lateral gastrocnemius (LG), and gluteus maximus (GM). Participants then ambulated along a 20-m walking area while 15 seconds of the gait cycle was recorded across 3 conditions: walking with a knee scooter, an HFSC, and with no assistive device. Mean muscle activity and peak EMG activity were recorded for each ambulatory modality. Immediately following testing, patient exertion and device preference was recorded.

**Results:** The RF, LG, and GM showed increased peak EMG activity percentage, and the LG showed increased mean muscle activity while using the HFSC compared to the knee scooter. When comparing the knee scooter and HFSC to walking, both showed increased muscle activity in the RF and VL, decreased in the LG, and no difference in the GM. There was no statistical difference in participant preference, whereas the HFSC had a statistically significant higher perceived exertion than the knee scooter.

**Conclusion:** The HFSC demonstrated increased peak EMG activity in most muscle groups compared with the knee scooter, while maintaining cyclic contractions consistent with bipedal gait pattern. This current study illustrates that a HFSC can maintain muscle activity similar to walking without an assistive device, while enhancing the cyclic contractions in the LG when compared to a knee scooter.

### *Current Treatment Trends in Pediatric Versus Adult Choroid Plexus Carcinoma: An Analysis of the National Cancer Database*

**Xinxin Wu**, Michelle Swedek, Julia Griffen, Timothy Malouff, and Peter Silberstein

Creighton University School of Medicine, Omaha, NE

Choroid Plexus Carcinoma (CPC), a subtype of choroid plexus tumors (CPT), is a rare central nervous system neoplasm thought to affect mostly the pediatric population. The epidemiology of CPC is poorly understood due to the rarity of the disease. By analyzing the National Cancer Database (NCDB), we describe the current treatment trends in pediatric versus adult choroid plexus carcinoma.

The majority of the cases analyzed were white (55.4%), male (54%), and pediatric patients (66.8%, mean age at diagnosis=15.17 years) with an average Charlson-Deyo Score of 0.24. The mean age at diagnosis of the pediatric population was 2.34 years (min=less than 1 years old/diagnosed in utero, max=16, std. deviation=3.84) while the mean age at diagnosis of the adult population was 43.49 years (min=18, max=84, std. deviation=18.23.) The most common primary site for CPC was malignant neoplasm of the cerebral ventricle (87.6%) followed by malignant neoplasm of the brain stem (5.9%). Surgical procedure of the primary site was performed in 92.6% of cases including local excision, subtotal resection, resection, radical resection, partial resection of a lobe of brain, lobectomy, and surgery NOS. Radiation was not used 71.3% of the time, but was more than three times as likely to be used in the adult population after surgery than in the pediatric population after surgery (44.4% vs 14.4%, p value<0.001). Most patients received chemotherapy (53%) with the administration of chemotherapy higher in the cohort less than 18 years old (69.8% versus 15.9%, p value<0.001). Multiagent chemotherapy was administered as the first course of therapy as the top chemotherapeutic choice (86%) especially among the pediatric population (88.6%) compared to the adult population (60%) Palliative care was not provided in any of the cases.

### *Circumstances Around Falls in Older Adults with Cancer*

**Ursulina Tomczak**, Schroder Satter, Kelly Schoenbeck, Theresa Corder, and Tanya Wildes

Creighton University School of Medicine, Omaha, NE

**Objectives:** Falls are increasingly worrisome to older adults with cancer due to the side effects of cancer and its treatments. Understanding the circumstances of falls is important in the development of fall prevention strategies. The aim of this study is to understand the circumstances of falls in older patients with cancer.

**Materials and Methods:** This study is a secondary analysis of a prospective cohort study in which adults aged  $\geq 65$  years with cancer receiving systemic cancer therapy were followed for fall outcomes for six months. Falls were assessed by monthly fall calendars; 51 participants who reported a fall were interviewed regarding the fall.

**Results:** The cohort had an average age of  $72.2 \pm 5.2$  years; 37% were female and 90% were white. Half (25/51) had experienced falls in the six months prior to enrollment. During the follow-up period, 78 falls occurred in 51 individuals over 6 months: 36 patients had 1 fall, 9 patients had 2 falls, 3 had 3 falls, and 1 each had 4, 5, or 6 falls. Nearly half of falls (51%) took place in the home and 38 (49%) occurred outside of the home.

**Conclusions:** Falls occurred at similar rates both inside the home and outside the home, indicating that familiarity with the person's surroundings does not protect against falls. Symptoms of cancer treatments were not mentioned during fall assessment, which may indicate a need for more awareness of the side effects of cancer medications and future developments of fall prevention methods.

65

### *Chronic Spontaneous Urticaria Following COVID-19 Vaccination Booster: A Case Report*

**Julia Drexelius**, Madeline Nottoli, and Jack Kirsch

Creighton University School of Medicine, Phoenix, AZ

The COVID-19 pandemic was caused by the SARS-CoV-2 virus, first identified in December 2019. By December 2020, two mRNA vaccines were issued Emergency Use Authorization by the U.S. Food and Drug Administration. The Pfizer-BioNTech and Moderna vaccines for COVID-19 have been shown to be highly effective in preventing infection with SARS-CoV-2 and reducing the risk of developing severe cases of COVID-19 in breakthrough infections. These vaccines have been invaluable in reducing the spread of COVID-19, but they are not without adverse effects. A case of chronic spontaneous urticaria (CSU) presented in a 23-year-old previously healthy female following vaccination with the Moderna COVID-19 booster shot. The condition presented 12 days after vaccination, characterized by pruritic wheals in areas of irritation (i.e. along clothes lines, scratches). The wheals increased in size and degree of pruritis with continued irritation but would fade within 30-60 minutes if the irritation was removed. A treatment regimen consisting of a second generation H1 antihistamine, with the eventual addition of an H2 antihistamine, was prescribed. After 3 months, the patient's symptoms have reduced in frequency and severity, but still occur on a regular basis. Many types of cutaneous reactions have been reported as adverse effects of COVID-19 vaccination. This case describes a unique presentation of CSU following administration of a COVID-19 vaccination booster in a healthy adult. Reporting of these events is necessary to increase awareness of possible side effects of COVID-19 vaccination and how they can be effectively managed. This information is essential for physicians to accurately diagnose, treat, and reassure patients with similar conditions. Unlike an anaphylactic reaction, this cutaneous reaction should not discourage future vaccination for COVID-19. Increased research on these types of reactions is important to increase public knowledge and vaccination efforts.

66

### *A Picture is Worth a Thousand Words: 3D Imaging of Peripheral Nerve Regeneration*

**Margaret M. McCann**, Asfia Numani, and Richard D. Dortch

Department of Biomedical Sciences, Creighton University School of Medicine, Omaha, NE

Peripheral nerve injury (PNI) can cause devastating, lifelong disability and occurs in up to 5% of Level 1 trauma patients in the U.S. [1]. Severe injuries require surgery, but up to 40% fail [2]. Early detection and correction of failed surgeries is crucial to long-term recovery. Up to 1% of functional recovery is lost every six days a nerve remains unrepaired [3]. Our lab develops MRI biomarkers of injury and recovery in peripheral nerves to help expedite diagnosis and management of PNI patients. These biomarkers need to be validated by histology, which captures the heterogeneous pathologies that occur after trauma. Tissue clearing allows 3D histologic visualization of tissue by reducing light scatter and increasing light penetration in cleared tissues. The harsh chemicals used to clear tissue, however, can cause rapid loss of tissue integrity. Recent advances in the field include a method, SHIELD, to help protect tissue from these effects [4]. Currently, there are no easily accessible protocols for clearing and imaging peripheral nerves using SHIELD, and prior clearing protocols require perfusion or yield blurry images due to antibody penetration difficulties and rapid degradation of tissue architecture. Here we present a method to obtain high quality images of rat peripheral nerves in a consistent and reproducible manner.

*A Multi-Institutional Collaborative to Develop and Validate Machine Learning Models Predictive of Occult Lymph Node Metastasis in Patients with Early Oral Cavity Squamous Carcinoma*

**Claire Tolan**, Nathan Farrokhian, Andrew J. Holcomb, Erin Dimon, Omar Karadaghy, Christina Ward, Erin Whiteford, Elyse K. Hanly, Marisa R. Buchakjian, Brette Harding, Laura Dooley, Justin Shinn, Burton Wood, Sarah Rohde, Sobia Khaja, Anuraag Parikh, Mustafa Bulbul, Joseph Penn, Sara Goodwin, and Andr  s Bur

Creighton University School of Medicine, Omaha, NE

**Importance:** Given that early stage OCSCC has a high propensity for sub-clinical nodal metastasis, elective neck dissection has become standard practice for many clinically node negative patients. Unfortunately, for the 70-80% that have no regional metastasis, this risk averse treatment paradigm results in unnecessary morbidity.

**Objectives:** To develop and validate models predictive of occult nodal metastasis from clinicopathologic variables available after surgical extirpation of primary tumor. To compare predictive performance against depth of invasion (DOI), the currently accepted standard

**Design:** Clinicopathologic variables were collected retrospectively.

**Setting:** This study utilized data from patients seen at seven tertiary care academic medical centers

**Participants:** cT1-2N0 OCSCC patients that underwent primary surgical extirpation with or without upfront END between 2000-2019.

**Exposure:** Largest tumor dimension, tumor thickness, DOI, margin status, lymphovascular invasion (LVI), perineural invasion (PNI), muscle invasion, submucosal invasion, dysplasia, histological grade, anatomical subsite, age, sex, smoking history, race, and BMI.

**Main Outcome(s) and Measure(s):** Occult nodal metastasis identified either at time of END or regional recurrence within two years of initial surgery.

**Results:** Patients with occult nodal metastasis had a higher frequency of LVI (26.3% vs 8.1%,  $p < 0.001$ ), PNI (40.4% vs 18.5%,  $p < 0.001$ ), and margin involvement by invasive tumor (12.3% vs 6.3%,  $p = 0.046$ ) compared to those without pathologic lymph node metastasis. Additionally, patients with occult nodal metastasis had a higher histological grade of the primary tumor ( $p < 0.001$ ) and greater DOI ( $p < 0.001$ ). A predictive model built with XGBoost architecture outperformed the most utilized DOI threshold of 4mm, achieving an AUC of 0.84 (95% CI, 0.80-0.88) versus 0.62 (95% CI, 0.57-0.67) with DOI. Compared to the DOI threshold, this model had a sensitivity of 91.7% (vs 62.5%), specificity of 72.6% (vs 61.3%), positive predictive value of 39.3% (vs 23.8%), and negative predictive value of 97.8% (vs 89.4%).

**Conclusion and Relevance:** When compared to DOI, machine learning models developed from multi-institutional clinicopathologic data more accurately identified patients at highest risk of nodal metastases. As such, these models show the potential to not only reduce the number of pathologically negative neck dissections, but more importantly, better identify patients who would benefit most from END.

## *Otoprotection From Aminoglycoside Toxicity in a LPS Zebrafish Lateral Line Neuromast Model*

**Bridgett Nelson**, Jonathan Fleegel, and Jian Zuo

Department of Biomedical Sciences, Creighton University School of Medicine, Omaha, NE

Aminoglycosides are an indispensable drug class used for the treatment of severe gram-negative bacterial infections, particularly in cases of sepsis and septic shock. However, a well-known side effect of aminoglycoside use is toxicity to the mechanosensory hair cells of the inner ear which can lead to permanent sensorineural hearing loss. Prior studies have demonstrated JAK-inhibitors momelotinib and fedratinib can prevent aminoglycoside mediated hair cell damage in an in-vivo zebrafish model. However, it has yet to be elucidated whether JAK-inhibitors can prevent aminoglycoside-induced ototoxicity in the setting of gram-negative sepsis. It has been shown that sepsis poses an elevated risk of ototoxicity likely due to associated high levels of lipopolysaccharide (LPS), an endotoxin from the outer membrane of gram-negative bacteria, which enhances trafficking of aminoglycosides across the blood-brain barrier. We aimed to assess whether LPS potentiates the effects of kanamycin toxicity and if JAK-inhibitors momelotinib and fedratinib can protect against kanamycin toxicity to mechanosensory hair cells in the presence of LPS in a zebrafish lateral line neuromast model. Zebrafish were raised and maintained using standard laboratory procedures. Number of hair cells per neuromast was assessed via immunofluorescence microscopy. Results confirmed that LPS potentiates aminoglycoside ototoxicity, as significantly more hair cell loss was observed in the kanamycin + LPS group versus kanamycin alone ( $p < 0.001$ ). Both fedratinib and momelotinib demonstrated protection against kanamycin-related hair cell loss. There was significantly less hair cell loss with fedratinib at  $13.3\mu\text{M}$  ( $p < 0.0001$ ) and momelotinib at  $0.165\mu\text{M}$  ( $p < 0.001$ ). Both JAK-inhibitors were found to be non-toxic to hair cells alone. These findings have far reaching implications for patients with severe bacterial infections necessitating the use of aminoglycosides. Future studies will aim to assess how JAK-inhibitors confer otoprotection from aminoglycoside toxicity in LPS mouse models.

## *TLR3-Mediated Expression of Inflammatory Cytokines in the Cochlea*

**William B. Meier**, Tian Cong, and Peter Steyger

Translational Hearing Center, Creighton University School of Medicine, Omaha, NE

**Background:** Aminoglycoside antibiotics can cause lifelong hearing loss in neonates with sepsis. Activation of TLR4 with systemic bacterial LPS induces an immune response that increases cochlear uptake of aminoglycosides, increasing the risk of hearing loss, i.e., cochleotoxicity. It is not known if viral sepsis, via activation of TLR3, can exacerbate cochleotoxicity, since viral sepsis can be erroneously treated with empiric aminoglycoside therapy. We hypothesized that systemic administration of the TLR3 agonist Polyinosinic:polycytidylic (Poly:IC) will induce cochlear expression of pro-inflammatory cytokines mRNA.

**Experimental Design:** Mice received intraperitoneal injections of Poly:IC prior to harvesting cochlear tissues at varying timepoints. Mice with hypofunctional TLR3 were used as a negative control. Cochleae were homogenized and processed for qRT-PCR to quantify the serum and cochlear expression of a panel of pro-inflammatory cytokine mRNA due to systemic Poly:IC.

**Results:** Poly:IC induced a significant increase of IFN $\gamma$ , IP-10, and IL-12 $\beta$  at all three time points compared to controls. A significant increase of TNF $\alpha$ , IL6, IL8, IL10 at 3 and 6 hours, with a return to baseline by 24 hours was also observed. In TLR3 KO mice treated with Poly:IC or saline, IFN $\gamma$ , IFN $\beta$ , IL6 and IL12 $\beta$  levels were not elevated compared to controls in contrast to significantly increased expression in Poly:IC-treated wildtype (B6) mice; this suggests that Poly:IC-increased expression of mRNA for proinflammatory cytokines are TLR3-signaling dependent. Similar expression of IL10 and IP10 in both TLR3 KO and B6 mice after Poly:IC treatment suggests an TLR3-independent mechanism.

**Conclusion:** Elevated mRNA expression profiles for inflammatory cytokines in cochlear tissue provides evidence of cochlear involvement in the systemic inflammatory response to viral sepsis modelled by Poly:IC in vivo. These data suggest that systemic activation of TLR3 induces inflammatory responses within the cochlea, increasing the risk of hospital medication-induced ototoxicity.

71

## *A Case of Multiple Admissions for Vitamin D Toxicity*

**Michelle Ngo**, Jessica Jacob, Nicholas Bowman, Santiago Garcia Ortiz, Binh T. Duong, and Osama Qasim Agha

Creighton University School of Medicine, Phoenix, AZ

**Case:** 74-year-old female with medical history of hypertension, hyperlipidemia, diabetes mellitus, and GERD presented with confusion, falls, polyuria, polydipsia, and vertigo. Labs were notable for WBC 14.4, Cr 1.85, BUN 17, calcium 16.3. Patient received 200 cc/hr IVF, calcitonin, and zoledronic acid. PTH was 8.0 (8.7-77.1), 25-vit D was 80 (30-60), and phosphorus was 4.4 (2.4-4.7). Negative work-up included CEA/CA 19-9, Cocci, and RPR. Urine immunofixation electrophoresis showed no monoclonal bands, low levels of IgM/IgG/IgA; urine protein electrophoresis with global proteinuria, serum protein electrophoresis with hypoproteinemia with hypoalbuminemia. CT chest showed no evidence of malignancy or lymphadenopathy. Bone survey was negative for lytic lesions. 1,25 dihydroxyvitamin D came back at 65.6 (19.9-79.3) after discharge. The patient was readmitted twice within the next two months for the same presentation because her underlying dementia prevented adherence to medical advice of discontinuing vitamin supplementation. She was discharged home on all occasions with recommended close outpatient follow-up.

**Discussion:** Vitamin D toxicity is an important but rarely reported cause of hypercalcemia. It is typically a diagnosis of exclusion after granulomatous diseases, hyperparathyroidism, osteolytic/paraneoplastic malignancy, thyrotoxicosis, adrenal insufficiency, and milk-alkali syndrome<sup>1</sup>. Neuropsychiatric symptoms include anxiety, fatigue, and cognitive dysfunction<sup>2</sup>. The literature describes causes including formulation errors, prescribing errors, and increasing use of supplemental high-dose products<sup>3,4,5</sup>. Publicity additionally boosts vitamin consumption without indication or supervision, posing a public health risk of misuse of over-the-counter supplements<sup>6</sup>. It is important to maintain a high clinical suspicion for vitamin D toxicity in patients that present in hypercalcemic crises despite its reputation for being a rare cause of this electrolyte disturbance. As with our patient, it is important to counsel patients on the potential adverse effects of excessive supplementation in order to prevent readmission for repeated overdoses.

72

## *Cecal Bascule in the Third Trimester: A Case Report*

**Rachel Wright**, R. Johnson, and A. Kinahan

Department of Obstetrics & Gynecology, Creighton University School of Medicine, Phoenix, AZ

Cecal bascule remains a rare form of cecal volvulus resulting from the anterior and superior displacement of a redundant cecum. Rapid uterine enlargement during pregnancy has been thought to contribute to an increased risk of cecal bascule in pregnant patients predisposed to the condition with a congenitally enlarged and redundant cecum. However, diagnosis is often delayed due to similarity in presentation with other more common etiologies of an acute abdomen. Here we present a unique case of cecal bascule in a third trimester pregnancy with early diagnosis and treatment. A 36-year-old female patient at 31 weeks 1 day gestational age presented to OB triage with one day of progressive abdominal pain and no bowel movement since onset of pain. CT scan was concerning for possible internal hernia or early cecal volvulus. Cecal bascule was revealed intraoperatively and patient underwent diagnostic laparoscopy converted to open right colectomy with ileocolonic anastomosis. Patient recovered well and was discharged on day three following return of bowel function. Cecal bascule is a rare form of cecal volvulus, associated with increased risk in pregnancy. Mass effect is thought to be the primary cause in affected individuals with underlying congenital or idiopathic redundant cecum. A high suspicion is imperative to early diagnosis and prompt surgical treatment in order to avoid serious complications including bowel perforation, ischemia, and increased mortality.

### *What Makes a Five-Star Orthopedic Sports Medicine Surgeon?*

**Noel Morgan**, Nicolas Kuttner, Zachary Lebaron, Evan H. Richman, Joseph C. Brinkman, and Anikar Chhabra

Creighton University School of Medicine, Phoenix, AZ

**Objectives:** The purpose of this study is to analyze the factors that contribute to earning a five-star review for sports medicine orthopedic surgeons.

**Methods:** Seventy orthopedic sports medicine surgeons were randomly selected from the American Orthopedic Society for Sports Medicine (AOSSM) website. A search was performed for these surgeons on Yelp.com. All reviews other than 5-stars (out of a possible 5 stars) were excluded from the study. Reviews were categorized as clinical or non-clinical and then subcategorized. Categorical variables were analyzed using a chi-square test. The rate ratio (rate for nonsurgical divided by surgical reviews) was determined for each category.

**Results:** 400 five-star reviews were included, comprising 1225 total compliments. 505 (41.2%) were clinically related and 720 (58.8%) were non-clinical. Of the 400 five-star reviews, 200 (50%) were from surgically treated patients and 200 (50%) were from non-surgical. The most common positive clinical comments were clear treatment plans (191 reviews, 48%), good outcomes (173 reviews, 43%), and providing alternative treatment options to surgery (55 reviews, 14%). The most common positive non-clinical comments were good physician bedside manner (287 reviews, 72%), friendly/professional staff (194 reviews, 49%), and ease of scheduling that contributed to no delays in care (68 compliments, 17%). Surgical patients had a non-significantly higher rate of clinical complaints than non-surgical patients (1.48 vs. 1.05 clinical complaints per review,  $p=0.177$ ). Non-surgical patients had a non-significantly higher rate of non-clinical complaints than surgical patients (1.87 vs. 1.73 non-clinical complaints per review,  $p=0.072$ ).

**Conclusion:** The majority of five-star reviews complimented nonclinical aspects of care such as physician bedside manner and friendly staff. The common clinical compliment was clear treatment plans and good outcomes. There was an equal number of reviews left by surgical and non-surgical patients with no difference in the factors leading to surgical and non-surgical patients leaving five-star reviews.

### *Incidence of Airway Abnormalities in Children with Craniosynostosis*

**Dana Eitan**, and Patrick Scheffler

Creighton University School of Medicine, Phoenix, AZ

**Introduction:** Children with syndromic craniosynostosis are known to have a high propensity for associated airway abnormalities. However, this has not been investigated using a large-scale national database.

**Methods:** For this retrospective cohort study the 2016 Healthcare Cost and Utilization Project Kid's Inpatient Database was queried for patients with craniosynostosis. Data on demographics, airway diagnoses and comorbidities were abstracted and analyzed.

**Results:** 4,914 children with craniosynostosis with a mean age of  $1.7 \pm 3.6$  years were identified. Of these, 51% were female and 136 children had an associated syndrome. Choanal atresia was present in 31% of patients with an associated syndrome compared to 2.5% without.

Syndromic patients are 4.59 times more likely (95% CI 2.65– 7.94) to have airway anomalies than nonsyndromic patients. After age and sex adjustment, it was determined that craniosynostosis patients have higher likelihoods of presenting with other various airway anomalies, with syndromic particularly having higher incidences: 5.23 times (95% CI 2.63– 10.39) more likely to have laryngomalacia, 18.30 times (95% CI 3.27 – 102.36) more likely to have tracheal stenosis, and 4.58 times (95% CI 1.36– 15.43) more likely to have tracheomalacia. Furthermore, the incidence of tracheostomy was 5.84 times (95% CI 3.77 – 9.04) higher in syndromic patients with craniosynostosis. Tracheostomy rates were 28.4% and 4.6% in craniosynostosis patients with and without associated syndrome, respectively.

**Discussion:** Patients with craniosynostosis had a significantly higher incidence of not only choanal atresia but also other various airway anomalies. Given the high incidence of airway anomalies, patients with syndromic craniosynostosis likely warrant routine airway evaluation. Providers should also be vigilant about airway evaluation in patients with nonsyndromic craniosynostosis when aerodigestive symptoms arise.

## **75**      *Scope of Practice Relation to Family Medicine Clerkship Director Evaluation of Medical Students*

**Dorothy Kenny**, Charissa Lau, and Jeffrey Curtis

Creighton University School of Medicine, Phoenix, AZ

The shortage of primary care physicians has persisted over time in the United States, likely due to multiple factors including a decline in student interest and poor experiences with family medicine curriculum. Simultaneously, concerns have been raised about a decline in the comprehensiveness of family medicine training and care (referred to as scope of practice). Family medicine match rates are positively correlated with family medicine clerkships offering more comprehensive clinical services, indicating that scope of practice in clerkships likely impacts students applying for residency. Data suggest that declining scope of practice and resources negatively impacts the quantity and quality of medical students entering family medicine residencies. We completed a secondary analysis of the 2014 CERA Family Medicine Clerkship Director (CD) Survey to answer: 1) Do CDs at programs with a broader scope of practice value skill development among medical students more than CDs at programs with a narrower scope of practice? and 2) Do CDs at programs with a broader scope of practice value personal characteristic development among medical students less than CDs at programs with a narrower scope of practice? Scope of practice was measured using the scope of practice index (SPI) defined by a prior analysis, and CD attitudes toward skill and characteristic development were determined using responses to the survey. 125 academic family physicians responded to the survey, of whom 105 provided full data on the variables assessed. There was no significant association between scope of practice and any specific characteristics. However, the presence of deficiencies in procedure skills and professionalism in family medicine residents may indicate steps need to be taken to improve development in these areas, even at schools and clerkships with more resources or broader scope of practice.

## DISTANCE PRESENTATIONS

### STUDENT ABSTRACTS

#### 1 *Toward Offline Adaptive Therapy for Prostate Patients using Velocity*

**Ellie Bacon**

Department of Physics, Creighton University, Omaha, NE

Current clinical treatments assume the patient anatomy will remain the same over the course of their treatment. However, we are seeing anatomical changes such as weight loss, tumor shrinkage, or bladder fill variations occur from day to day. This changing anatomy can have dosimetric impacts on the patient ranging from over or under treating our target volume or organs at risk. Due to these concerns, we are investigating the use of the software, Velocity, to track the bladder fill variations in a small cohort of prostate patients and determine if these variations have any significant dosimetric impacts. Within Velocity, we investigated three different workflows and compared their results against our known daily anatomy (CBCT image). The three workflows included the default navigator workflow with a full region of interest, the default navigator workflow with a reduce region of interest, and a structure guided workflow. Out of the three workflows, the structure guided provided us with deformed volumes that most closely matched the CBCT volumes. To compare the dosimetric impacts of the bladder fill variations we compared the V40 of each workflow to the “True” dose.

#### 2 *Visual Perturbation does not Impact Single-Leg Forward hop Landing Biomechanics in Collegiate Soccer Players*

**Cody Cooper**<sup>1</sup>, Taylor, Jaclyn<sup>1</sup>, Bankers, Scott<sup>2</sup>, Barber, Mallory<sup>2</sup>, Spencer, Aaron<sup>2</sup>, Farmer, Brooke<sup>1</sup>, Grindstaff, Terry<sup>1</sup>

<sup>1</sup>Department of Physical Therapy, and <sup>2</sup>Athletics Department, Creighton University, Omaha, NE

**Purpose:** Lower extremity injury negatively impacts visual processing and motor control as well as creates a greater reliance on vision to perform lower extremity motor tasks. Many sports are played in close quarters where vision is disrupted during quick movements. Minimal research has been done regarding the effects that visual disruption has on landing biomechanics. The purpose of this study was to determine the effects that disrupted vision has on single-leg forward hop landing biomechanics.

**Methods:** Thirty-six NCAA Division I soccer athletes were included in the study (21 female, 15 male; age=20.4±1.2 y; height=173.2±10.1 cm; mass=67.8±9.8 kg) as part of a larger battery of performance tests conducted during the off-season. Participants performed three single-leg forward hop (50% height) trials, onto a force platform, and maintained a stable landing position for 3-5 seconds. Next, each participants wore stroboscopic glasses that created a visual perturbation and performed another three single-leg forward hops. Outcome measures included peak ground reaction force (GRF/kg) and time to stabilization (TTS; seconds). A mixed-model repeated measures ANOVA was used to determine differences between sides (dominant/non-dominant) and conditions (with and without visual disruption).

**Results:** There was no significant interaction (side x condition) for peak GRF (p=0.28) or time to stabilization (p=0.25). Additionally, there was no significant differences between sides (GRF p=0.36; TTS p=0.21) or conditions (GRF p=0.13; TTS p=0.09).

**Conclusion/Significance:** A visual perturbation, using stroboscopic glasses, did not negatively impact single-leg forward hop landing forces or time-to-stabilization in collegiate soccer players. While full occlusion of vision (i.e., blindfold) negatively impacts bilateral landing biomechanics in healthy individuals, studies that utilize a visual perturbation such as stroboscopic glasses, have demonstrated mixed findings for healthy individuals. The current study suggest that healthy individuals can respond to a visual perturbation to maintain a landing strategy that is consistent with one with full vision.

3

### *Scoping Review of Occupational Therapy Assessments for Caregivers of Young Children with Diabetes*

**Megan Eiberger**, M. O'Brien, S. Fellman, Vanessa Jewell, Julia Shin, and Emily Enezevich

Department of Occupational Therapy, Creighton University, Omaha, NE

**Importance:** 200,000 American youth under 20 years old are currently living with type 1 diabetes; a number expected to increase to 600,000 by the year 2050 (JDRF, n.d.). This statistic suggests an equally considerable number of caretakers for these medically complex youth. Currently, there is a lack of assessments used in healthcare that measure the wellbeing of caregivers of children with type 1 diabetes, and none exist specific to the field of occupational therapy. Fortunately, occupational therapists have the expertise to create a relevant assessment targeting caregiver health for this population.

**Objective:** This study aims to identify assessments used across health care disciplines that measure psychosocial adjustment, caregiver burden, and health management routines for informal caregivers of children with type 1 diabetes.

**Data Sources:** The researchers searched PubMed, CINAHL, and PsychInfo, in addition to performing a hand search.

**Study Selection and Data Collection:** Following PRISMA guidelines, the researchers screened and appraised articles that included an assessment used to measure psychosocial adjustment, caregiver burden, or health management routines for caregivers of children with type 1 diabetes that were peer-reviewed, written in English, and published since 2011.

**Findings:** The initial search was conducted on October 13, 2021 with 1,620 articles meeting the criteria. After title and abstract screenings, eight of these articles were selected for full-text review. Researchers are in the process of completing a hand search to determine if other established assessments meet specifications for further review.

**Conclusions and Relevance:** Findings will help identify relevant diabetes assessments for occupational therapy practice and can inform practitioners of evidence-based materials to use in addressing health management for caregivers of children with diabetes. The results can further occupational therapy's role in this emerging practice and assist with improving the quality of healthcare outcomes for families of children with type 1 diabetes.

4

### *Psychometric Testing of the Diabetes Health Management and Distress Scale - Parents of Young Children (DHMDS-PYC)*

**Micaela Huhn**, Hope Signa, Vanessa Jewell, Julia Shin, Sarah Fellman, and Emily Knezevich

Department of Physical Therapy, Creighton University, Phoenix, AZ

This study aims to create a novel occupational therapy diabetes-specific assessment of the health management and parent-specific diabetes distress of children with type I diabetes (T1D). Between 2001 and 2017, the incidence of T1D in this population increased by 45% (Centers for Disease Control and Prevention, 2021). In 2018, the CDC determined that 25 per 100,000 US children and adolescents under the age of 20 years old have been diagnosed with T1D (CDC, 2020). This increase in change has escalated the concern for the well-being of children with T1D and their parents/caregivers. It is important that parents feel secure and capable in their everyday health management routines and occupations involved with caring for their child living with type I diabetes. This assessment would allow occupational therapy practitioners to gain a more comprehensive understanding of parents' distress levels and health management routines of their children's diabetes, and as a result, advance the interventions provided to benefit health outcomes and quality of life of individuals with T1D and their families. The goals for Phase I and Phase II of this four-phase study are to establish content validity, a preferred response format, and ecological validity of the assessment. Currently, the research team is refining a rough draft of the assessment in collaboration with stakeholders and interprofessional co-investigators. Two focus groups with healthcare providers and parents of children with type I diabetes will be held over Zoom to receive feedback on the response format, ecological validity, and content validity of the initial

assessment. The research team has developed a questionnaire which will be used as a guide for the focus groups, including a semi-structured format to allow for open conversation and garner contemplative responses. Discussions between the researchers of Creighton and University of Southern California (USC), along with their practitioners, will provide feedback on the focus group questionnaire and the Diabetes Health Management and Distress Scale-Parents of Young Children (DHMDS-PYC). By the end of Phase II of this study, the researchers will have gained qualitative and quantitative findings on the response format, content validity, and ecological validity of the DHMDS-PYC, as well as having created a final version of the assessment. The implications of this study for future occupational therapy practice include more informed treatment of children with T1D and their parents' and/or caregivers' psychosocial care in order to improve health outcomes, diabetes management, and overall quality of life for these families.

## 5

### *Implementation and Evaluation of the Palliative Care and Rapid Emergency Screening (P-CaRES) Tool for Use in Adult Intensive Care Unit (ICU) Patients*

**Jennifer Kennedy**, and Amy Abbott

Creighton University School of Nursing, Omaha, NE

**Purpose:** Implementation of a palliative care screening tool into the electronic medical record (EMR) for use on patient admission or transfer to the intensive care unit (ICU) to promote earlier palliative care utilization for critically ill adult patients.

**Background:** ICU patients are at an increased risk of morbidity and mortality. Early inpatient palliative care consultation results in reduced readmissions, a decrease in inpatient mortality rates, and a decrease in hospital length of stay. However, ICU patients who would benefit from specialty palliative care often are unrecognized until late in their critical illness.

**Sample/Setting:** Adult patients admitted to the medical ICU at a Midwestern Level III trauma hospital during a 6-week study period (N=155).

**Methods:** The Palliative Care and Rapid Emergency Screening (P-CaRES) tool, a reliable and valid tool used in Emergency Rooms, was embedded into the EMR of the study facility for testing in ICU patients. The P-CaRES was completed by bedside nurses either on transfer or admission to the ICU. A positive screen resulted in a best practice advisory for the attending provider to order a formal palliative consult.

**Results:** 92 P-CaRES screens (59%) were completed correctly on admission or transfer while 63 (41%) of screens were either not completed or completed incorrectly. Of the positive screens (n=11), 73% had a palliative consult ordered. While there were only 11 positive screens, 46 (30%) patients received a palliative care consult. Ultimately 29 (19%) of study patients died within 30 days of their ICU stay.

**Conclusion:** Study findings support the importance of early palliative care involvement in the ICU. When completed correctly, the P-CaRES is a valid screening tool that can be used in the ICU setting to identify critically ill patients that would benefit from palliative care consultation.

6

### *Clinical Validation of a Novel Smartphone Application for Measuring Visual Acuity*

**Mari Ogino**, Stephen Hunter, Vincent Hussey, Donny Suh, Rosa Salmerón-Campillo, Norberto López-Gil, and Matt Jaskulski, Matt

Creighton University School of Medicine, Phoenix, AZ

**Purpose:** The present study aims to clinically validate the novel smartphone application, VisionApp, in the measurement of visual acuity (VA) using comparative statistics against traditionally obtained measurements during a comprehensive eye exam. The goal defined by the study team was to validate whether the accuracy of VA measured by the app was comparable to measurements of VA taken by an ophthalmologist.

**Introduction:** In the wake of the COVID-19 pandemic, there has been a push to expand the utilization of telemedicine across all medical specialties. The ever-expanding reliance on technology poses specific challenges for ophthalmologists and optometrists alike as there is an unmet need to accurately measure and transmit the results of remote visual acuity assessments. VisionApp is a novel smartphone application that presents the opportunity to address this issue by measuring VA through dynamic optotype scaling based on the face-device distance in real-time.

**Methods:** The best-corrected VA (BCVA) and non-corrected VA (NCVA) in n=48 eyes were measured using the VisionApp. Results were compared to BCVA measurements taken using a standard Snellen chart placed at 10 feet (3m). To assess the similarity of measurement methods, a statistical analysis was performed based on a two-tailed, paired t-test.

**Results:** The t-test revealed no significant difference in measured VA ( $p = 0.415$ ), with a mean difference between clinical and app measurements of less than one letter ( $0.005 \log\text{MAR}$ ).

**Conclusion/Relevance:** There was no statistically significant difference between VA measured using VisionApp compared to clinical measurements. This has the potential to facilitate home monitoring for adult patients; however, further research is warranted to validate the use of VisionApp in children. The newly validated study results have major implications in advancing telemedicine and providing ophthalmologists with a reliable and accessible method to measure VA and communicate results remotely between providers and patients.

7

### *The Relationship Between Time to Stabilization and the Dynamic Leap and Balance Test in Soccer Athletes*

**Treva Rice**, Brooke Farmer, Terry Grindstaff, and Abbis Jaffri

Department of Physical Therapy, Creighton University, Omaha, NE

**Introduction:** Dynamic balance is essential while performing movements during sporting and athletic activities such as running, cutting, and lunges etc. Dynamic Leap and Balance Test (DLBT) is a novel dynamic balance test in which the base of support is serially changing and leaping movements. However, we don't know if the time taken to complete the task or errors made in the DLBT are associated with Time to stabilization (TTS) in athletes.

**Methods:** This was a cross-sectional lab-based study. 24 (6M;18 F, Age:  $18.21 \pm 0.41$  yrs, mass:  $66.64 \pm 8.37$  kgs, height:  $168.93 \pm 22.46$  cm) soccer athletes participated in this study. DLBT trials were conducted and time (in seconds) to complete the task and overall errors made during the task were measured. TTS was measured using force plate data while participants performed single leg drop vertical jump and hold on force plate. Left leg was used for all the measurements.

**Results:** Significant ( $P=0.01$ ) correlation of  $r=0.48$  was found between the TTS in the drop vertical jump and the time taken to complete the in the DLBT. No significant ( $P=0.09$ ) correlation of  $r=0.35$  was found between the TTS in the drop vertical jump and total errors made on the DLBT.

**Conclusions:** The strong correlation between the time taken to complete the DLBT task and TTS during drop vertical jump. This shows that the DLBT which is a clinician friendly, cost-effective balance test can give the same information that TTS provides using expensive force plates. The DLBT can be a good alternative to obtain information about TTS in the clinical settings.

### *Comparison of Hamstring Strength Between Unilateral Isokinetic and Bilateral Nordic Hamstring Testing in NCAA DI Soccer Players*

**Tanner Strommen**, Rachel Bergen, Scott Banders, Mallory Barber, Aaron Spencer, Brooke Farmer, and Terry Grindstaff

Department of Physical Therapy and Department of Athletics, Creighton University, Omaha, NE

**Purpose:** Hamstring strength is a performance metric associated with both injury risk and return to activity decisions following sport related injury. Multiple testing options exist, but it is not clear if they are interchangeable. The purpose of this study was to compare peak hamstring force and limb symmetry index (LSI) values when using an electromechanical dynamometer and an eccentric instrumented testing device.

**Methods:** Forty-six healthy NCAA Division I soccer players (27 female, 19 male; height=169.5±27.2 cm mass=68.9±9.6 kg) completed measures of hamstring strength using an electromechanical dynamometer (60°/second) and an eccentric instrumented testing device. Outcomes measures included peak torque/force (Nm or N) and LSI (lowest torque/force divided by highest torque/force). Differences between sides, across testing devices, were determined using paired t-tests. The relationship between devices was determined using Pearson product-moment correlation coefficients.

**Results:** There was no significant difference between sides for the dynamometer ( $p=0.79$ ; right=107.5±27.5 Nm, left=106.7±28.6 Nm) or the instrumented testing device ( $p=0.14$ ; right=338.1±71.2 N, left=346.5±74.9 N). There was also no significant difference ( $p=0.81$ ) between LSI values for the dynamometer (102.9±11.5%) or the instrumented testing device (102.2±16.8%). Correlations between devices were considered moderate to good and ranged from 0.616 (95% CI=0.390 to 0.772) to 0.711 (95% CI=0.524 to 0.832) for the right and left sides, respectively. Correlations between LSI values across devices were considered poor ( $r=0.228$ ; 95% CI=-0.073 to 0.492).

**Conclusion:** The moderate to good correlation between devices suggests the more clinically friendly eccentric instrumented testing device is a valid option to obtain measures of hamstring strength. Unfortunately, there appears to be a high degree of variance between the devices when calculating LSI values, an important metric for injury risk and return to activity. These differences may be due to the bilateral nature of the eccentric hamstring exercise compared to the unilateral assessment that occurs on the electromechanical dynamometer.

## 9 *Squat Symmetry Norms in Healthy Collegiate Athletes*

**Jaclyn Taylor<sup>1</sup>**, Kim Namwong<sup>2</sup>, Brian Knarr<sup>2</sup>, Brad Schmitt<sup>3</sup>, Scott Bankers<sup>3</sup>, Brooke Farmer<sup>1</sup>, and Terry Grindstaff<sup>1</sup>

<sup>1</sup>Department of Physical Therapy, Creighton University; <sup>2</sup>Department of Biomechanics, University of Nebraska Omaha; <sup>3</sup>Department of Athletics, Creighton University, Omaha, NE

**Purpose:** Individuals within the first two years of anterior cruciate ligament (ACL) reconstruction often demonstrate a relative unloading pattern of the involved limb across a variety of functional tasks including running, jumping and squatting. Symmetry between limbs (limb symmetry index [LSI]), is a common clinical measure, but it is not clear how much asymmetry is normal for squatting biomechanics in collegiate athletes across sports. The purpose of this study was to determine normal symmetry values across sports to provide clinicians with normative baseline for squat performance.

**Methods:** 117 healthy NCAA Division I collegiate athletes (57 female, 60 male) performed a series of five bilateral squats, with each respective foot on a force plate, as part of a battery of performance tests. The main outcome measure was the vertical ground reaction force (vGRF) measured between limbs. Separate mixed model ANOVAs were used to determine differences between sexes and teams (women's soccer, men's soccer, women's basketball, men's basketball, baseball, volleyball). Additionally, frequency counts were calculated to determine the number of individuals who were above typical 90% LSI thresholds.

**Results:** There was no significant difference ( $p = 0.45$ ) in squat LSI values between males ( $92.6 \pm 3.5\%$ ) and females ( $92.0 \pm 4.3\%$ ). Additionally, there were no significant differences ( $p = 0.90$ ) between sports, with all LSI values between 91-92%. Nearly 74% of participants had LSI values  $> 90\%$ .

**Conclusion/Significance:** While collegiate athletes demonstrate relatively symmetrical squat performance, but approximately 25% of athletes had values that fell below the 90% LSI threshold. Although there was not a significant performance difference between limbs, the degree of asymmetry (e.g. LSI values) should be considered when utilizing an LSI of 90% as a clinical threshold. Additionally, the inclusion of normative values for male and female Division I collegiate athletes can serve as another relevant clinical benchmark.

**Acknowledgements:** SPAHP Student Research Fellowship Grant

## 10 *Impact of Multidisciplinary Rounds in a Cardiothoracic Intensive Care Unit (ICU)*

**Hannah Wirtz Murphy**, and Amy Abbott

**Purpose:** To develop and implement a rounding and communication process using multidisciplinary rounds (MDR) for cardiothoracic patients admitted to the ICU.

**Background:** MDR, as supported by Institute for Healthcare Improvement and the Agency for Healthcare Quality and Research, are essential to provide safe and effective care for critically ill patients and to avoid fragmented communication, care delays, errors, and prolonged ICU stays. Errors in the ICU are attributed to lack of teamwork and miscommunication.

**Sample/Setting:** All cardiothoracic patients (N=41) cared for by a single intensivist group from July 14th-November 13th, 2021 were included from a 24-bed cardiothoracic ICU in Southwestern United States.

**Methods:** Evidenced-based literature review indicated MDR positively impact patient care through improved communication and length of stay (LOS) reduction. Best practice was translated into standardized daily rounding sheet, a multidisciplinary team was formed and educated prior to implementation. The ICU Nurse-Physician Questionnaire (ICU-NPQ) was administered pre- and post-MDR initiation. Data from the medical record was collected retrospectively.

**Results:** The pre-implementation group (n=22) patients and the study group (n=19) had no statically significant demographic differences. The LOS, foley and central venous catheter (CVC) days all decreased but not significantly. The average LOS was 129.2 hours (SD=197.6), and 81.2 hours (SD=83.9) for the pre-implementation and study groups, respectively. Average foley and CVC days

decreased non-significantly post-MDR implementation. No central line or foley-associated infections occurred. The ICU-NPQ depicted nurses' reports of improved interprofessional communication. Improvements post-implementation in understanding communications and asking for advice were noted by both nurses and providers.

**Conclusion:** This quality improvement project provided an opportunity to initiate MDR in a cardiothoracic ICU. While no significant reduction in the project's quality metrics occurred, replication with a larger sample size and stronger stakeholder support is warranted as literature indicates MDR provide organized communication thereby reducing errors and improving outcomes.