Medical Student Research Day Program and Abstract Book

September 7, 2024

Burrell College of Osteopathic Medicine

Office of Research and Sponsored Programs

Contents

President's Welcome Address

It is my privilege to welcome you to the Burrell College of Osteopathic Medicine's 2024 Medical Student Research Day (MSRD)!

Thank you to our participants and visitors for attending the College's premiere student research event. This is the seventh year that the College has hosted this event and I could not be prouder of the students and faculty who have put forth so much effort to make this day possible. Medical Student Research Day is an immensely important day for our students. Not only does MRSD provide our students the opportunity to gain experience that will give them a competitive edge when applying for future residency programs, it also promotes the research and scholarly efforts of the College on a national scale.

I am pleased to see such an impressive turnout of student abstract submissions by our medical students. The research studies presented have significance because of their potential for translation to Osteopathic Medicine. I would like to take a moment to recognize the efforts of our faculty and staff members at the Burrell College Research Laboratories. Without our research mentors and the dedication of the staff of the Research Office, none of this would be possible. The Burrell College research community is a rising force, already making significant contributions to advancing knowledge in basic, clinical, and applied biomedical research.

It is my hope that you will engage with our student researchers and their mentors to learn both about their current projects and the ongoing investigative endeavors of the Burrell College Research Laboratories.

John L. Hummer, MHA
President & Co-Founder
Burrell College of Osteopathic Medicine

Dean's Welcome Address

It gives me great pleasure to recognize the many students who traded their summer break for an opportunity to further their own education in the field of research. This year's Summer Research Program encompasses investigations in population health, including infectious disease prevention, human physiology, anatomy, pathology and clinical medicine, a testimony to the varied interests of our students and their faculty mentors.

I am encouraged to see those interested in becoming the next generation of physician-scientists helping advance our medical knowledge for the benefit of our profession and our patients. Please join me in appreciating their enthusiasm to share the skills and knowledge they have gained from this experience.

William Pieratt, DO, FACP
Dean and Chief Academic Officer
Burrell College of Osteopathic Medicine

Schedule Overview	
8:00 AM	Coffee/Pastries Poster viewing *(Authors present posters later)* **Room 208**
9:00 AM	Welcome Remarks *Thomas P. Eiting, Ph.D., Director of Student Research* **Room 208**
9:05 AM – 10:15 AM	Poster Presentations *Student authors present their posters.* *Odd #s: 9:05- 9:40 a.m.; Even #s: 9:40 – 10:15 a.m.* **Room 208**
10:15-10:30 AM	Break **Room 208**
10:30-11:30 AM	Oral Presentations **Room 158 and via zoom https://burrell-edu.zoom.us/j/91907775261** **[Meeting ID: 919 0777 5261 Passcode: 268728]**
11:30 – 12:00 Noon	Lunch **Room 158**
12:00 -1:00 PM	Keynote Address – Harald M. Stauss, MD, Ph.D. *Professor of Pharmacology* "Vagus Nerve Stimulation in Cardiovascular, Metabolic, and Chronic Inflammatory Diseases: From Rodents to Patients" **Room 158**
1:00 PM – 1:05 PM	Closing Remarks *Alex V. Gasparian, Assistant Dean of Research* **Room 158**

Schedule in Detail

Opening Remarks. 9:00 – 9:05 am, Room 208

Thomas P. Eiting, Ph.D.
Director of Student Research, Burrell College of Osteopathic Medicine

Poster Presentations. 9:05 – 10:15 am, Room 208

Note: Posters with an Odd Number, Authors present from 9:05 am – 9:40 am;
Posters with an Even Number, Authors present from 9:40 am – 10:15 am.

P1. Serological prevalence of Coccidioides Spp. in Southern New Mexico
Jake Harb, Shiza Jamil, Sloan Johnson, Bryce Platt, Carolyn Robert
Mentor: Michael Woods

P2. Immunohistochemistry and Genetic Techniques to Detect SARS-CoV-2 in Bats of New Mexico
Rewa Almughawish, Sheena Bettis, Kellee Diaz, Cathy Tran
Mentor: Thomas Eiting

P3. *(Withdrawn due to Unforeseen Circumstances)*

P4. A Community Effort of Skin Cancer Recognition
Simran Bhakta, Tyler Peters
Mentor: Debra Bramblett

P5. Mindfulness as a Potential Protective Behavior Against Stress-Associated Vision Loss
Jeffrey S. Briggs
Mentor: Kristin L. Gosselink

P6. Assessing and Improving Healthcare Provider Knowledge About HPV and the HPV Vaccine to Promote Vaccine Uptake
Malia Gonzales*, Radha Patel*, Katie LaRoche, Nancy Somo, and Aislin Sullivan
Mentor: Kristin L. Gosselink

P7. Cancer Prevention: Impact of Healthcare Provider Intervention on Communication About HPV and the HPV Vaccine in El Paso County and Southern NM
Nancy J. Somo*, Aislin Sullivan*, Katie LaRoche, Malia Gonzales, and Radha Patel
Mentor: Kristin L. Gosselink

P8. Validating Self-Management of Disease: Novel Patient-Driven Study Design Applied to Paroxysmal Atrial Fibrillation
Alexander T. Morris, Joe Brinza
Mentor: Harald M. Stauss

P9. Role of Curcumin Nanoparticles in Abolishing Inflammatory Breast Cancer Emboli
 Niketa Dixit, Caitlin M. Blades, Weam Elbezanti, Kenneth L. van Golen
 Mentor: Arun Kumar

P10. Anti-inflammatory effects of occipitoatlantal decompression and transcutaneous auricular vagus nerve stimulation
 Arsany Farid, and Komal Khokhar
 Mentor: Harald M. Stauss

P11. Short-Lever Assessment of Spinal Side-Bending
 Fatima Khalil, Matthew McClendon, Kaili Sudweeks
 Mentor: Adrienne Kania

P12. Investigating the Efficacy of OMT to Recover Olfactory Perception After COVID
 Sahej Dodd and Ranya Aziz
 Mentors: Adrienne Kania and Thomas Eiting

P13. Digital Surgery of Nasal Airways
 Samantha Lester, Simran Bhakta, LaShay Taylor, Alexis Fastle
 Mentor: Thomas Eiting

P14. CT scan and 3D modeling reveals hidden features of fossil mammals from Palm Park, New Mexico
 Alex Barrera, Janie Williamson, Steven Zhao
 Mentor: Spencer Mattingly

P15. Traumatically Induced Holmes Tremor with Neuroanatomic Correlation and Video Documentation
 Ridhika Prasad, Dalia Gazallo
 Mentor: Robert Coni

P16. Gastroschisis
 Priya Patel
 Mentor: Richard Towbin

Break. 10:15 – 10:30 am, Coffee/tea/cookies, Room 208

Please make your way down to Room 158 while enjoying your treats, as our oral presentation session will begin promptly at 10:30.

Oral Presentations. 10:30 – 11:30 am, Room 158

Zoom link: https://burrell-edu.zoom.us/j/91907775261 [Meeting ID: 919 0777 5261 Passcode: 268728]

10:30 – 10:45 am.

O1. Pulmonary Artery Aneurysm Secondary to Pulmonary Stenosis and Congenital Heart Disease
Brandon Cunningham
Mentor: Mohan Muvvala

10:45 – 11:00 am.

O2. Beyond PCR: The SHERLOCK Assay – A CRISPR/CAS-13 Based Method of Detection for West Nile Virus
Emily Kong
Mentor: Debra Bramblett

11:00 – 11:15 am.

O3. Evaluation of GMSCs viability seeded on a moldable scaffold
Lato Nguyen, Andre Prieto
Mentor: Umadevi Kandalam

11:15 – 11:30 am.

O4. Title: Association of pre- and poly-fluoroalkyl substances (PFAS) with depression in the US population: A cross-sectional study
Weston R. Stokey
Mentor: Humairat H. Rahman

Lunch. 11:30 am – 12:00 pm, Room 158

Please grab a plate and join your friends for lunch in room 158 or wherever you like. Our keynote speaker will begin promptly at 12:00 pm; feel free to enjoy lunch while attending the keynote.

Keynote Address. 12:00 – 1:00 pm, Room 158

Vagus Nerve Stimulation in Cardiovascular, Metabolic, and Chronic Inflammatory Diseases: From Rodents to Patients
Harald M. Stauss, MD, Ph.D.
Professor of Pharmacology, Burrell College of Osteopathic Medicine

Closing Remarks. 1:00 – 1:05 pm, Room 158

Alex V. Gasparian, Ph.D.
Assistant Dean of Research, Burrell College of Osteopathic Medicine

Abstracts – Poster Presentations

P1. Serological prevalence of Coccidioides Spp. in Southern New Mexico

Jake Harb, Shiza Jamil, Sloan Johnson, Bryce Platt, Carolyn Robert
Mentor: Michael Woods

Objective: The South West United States is well-known as an endemic area for coccidioidomycosis, commonly referred to as "Valley Fever," caused by the inhalation of Coccidioides species. New Mexico has been recognized as part of this endemic region since its identification in 1949 by Harold Chope. Despite its endemic status, there is limited understanding of exposure rates and infection prevalence due to inadequate testing and a lack of comprehensive studies.

Methods: To investigate exposure rates in Southern New Mexico, we surveyed local subjects and inquired about their living history and any previous diagnosis of coccidioidomycosis, then collected blood samples for immunodiffusion testing.

Results: So far, no subjects have tested positive for IgG or IgM antibodies, even though one individual reported a prior coccidioidomycosis diagnosis. This absence of positive results may be attributed to testing limitations, particularly the rapid decline of anti-Coccidioides antibodies within 12 months, seasonal fluctuations of coccidiosis prevalence, and lack of adequate sample size to estimate true seroprevalence.

Conclusion: Future efforts will focus on recruiting and testing additional participants and exploring alternative testing methods. The South West United States is well-known as an endemic area for coccidioidomycosis, commonly referred to as "Valley Fever," caused by the inhalation of Coccidioides species. New Mexico has been recognized as part of this endemic region since its identification in 1949 by Harold Chope. Despite its endemic status, there is limited understanding of exposure rates and infection prevalence due to inadequate testing and a lack of comprehensive studies. To investigate exposure rates in Southern New Mexico, we surveyed local subjects and inquired about their living history and any previous diagnosis of coccidioidomycosis, then collected blood samples for immunodiffusion testing. So far, no subjects have tested positive for IgG or IgM antibodies, even though one individual reported a prior coccidioidomycosis diagnosis. This absence of positive results may be attributed to testing limitations, particularly the rapid decline of anti-Coccidioides antibodies within 12 months, seasonal fluctuations of coccidiosis prevalence, and lack of adequate sample size to estimate true seroprevalence. Future efforts will focus on recruiting and testing additional participants and exploring alternative testing methods.

P2. Immunohistochemistry and Genetic Techniques to Detect SARS-CoV-2 in Bats of New Mexico

Rewa Almughawish, Sheena Bettis, Kellee Diaz, Cathy Tran
Mentor: Thomas Eiting

Objective: Bats have been linked to human disease outbreaks in the 21st century, such as Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV). Exploring the bat origin of human coronaviruses is helpful for the prediction and prevention of another pandemic emergence in the future, as well as to better understand the ecological and population dynamics of coronaviruses in bats. The project's goal is to optimize the hematoxylin and eosin (H&E) immunohistochemistry (IHC) protocols to detect SARS-Cov-2 in bats.

Methods: We observed 196 tissue specimens from six species within the local Southwest United States region and two neotropical species that are extracted from lab-based colonies. The samples observed in this project were derived from lung, kidney, and nasal septum, nasal bat tissue specimens that were fixed in 10% formalin. In the Burrell Scientific Research Lab, specimens were dehydrated through a graded ethanol series, cleared with Histoclear, then embedded in paraffin wax. A rotary microtome was used to generate 10-micron sections which were mounted on microscope slides and then either stained with the hematoxylin and eosin (H&E) or immunohistochemistry (IHC) protocols. H&E staining was used to visualize cellular structures. Immunohistochemistry staining was used to detect SARS-CoV-2 in the collected specimens. Two primary biotinylated antibodies using 1:1000 dilution were utilized in parallel for each specimen type: SARS-CoC/SARS-CoV-2- Nucleocapsid antibody (Mouse Mab) and SARS-CoV-2 (2019-nCoV) Spike S1 antibody (Rabbit Mab). Different preliminary assay methods of control were used including secondary antibody counterstain in the absence of primary antibody stain, as well as the staining of SARS-CoV-2 positive human placenta tissue. This was to assure our staining protocol is accurate allowing us to continue moving forward with our project on more bat specimens.

Results: Preliminary results for the detection of SARS-CoV-2 using SARS-CoC/SARS-CoV-2-Nucleocapsid antibody (Mouse Mab) and SARS-CoV-2 (2019-nCoV) Spike S1 antibody (Rabbit) were negative in the collected bat specimens. After optimization of the embedding and Immunohistochemistry protocols, one specimen, labeled EF02 Right Lung, belonging to bat species *Eptesicus fuscus*, yielded a positive result. The positive result was determined by microscopic imaging, using the human placenta positive control in comparison. There was the presence of nucleocapsid aggregates noted on the lining of the alveolar spaces of the EF02 Right Lung specimen at magnification 40x, 100x, and 400x. This finding is significant as it highlights the presence of SARS-COVID-19 in the lung tissue.

Conclusion: After 6 weeks, we optimized the incubation times for various steps of the procedures including the Hematoxylin and Eosin staining procedures, Avidin-Biotin Complex within our IHC procedure, and PBS soaking after staining with DAB to minimize background staining and assure the antibodies are the primary target with our stains. These methods were used on negative control human placenta, positive control human placenta, and one bat specimen (EF02 R Lung) with success. Given the time frame of the project, we were not able to detect any more specimens with our staining procedure. SARS-CoV-2 positive human lung tissue was provided as another control option. Unfortunately, it was casted improperly and not able to be used. For future directions, the specimen collection and preparation may be streamlined, in order to maximize tissue use. The lung sample can be re-casted and used to add more quality control. In addition, there will be an integration of molecular techniques such as Polymerase

Chain Reaction (PCR) alongside Immunohistochemistry that will provide a more comprehensive understanding of the significance of bats as reservoirs for SARS-COVID-19 in the Southwest United States Region.

P3. *(Withdrawn due to Unforeseen Circumstances)*

P4. A Community Effort of Skin Cancer Recognition
Simran Bhakta, Tyler Peters
Mentor: Debra Bramblett

Objective: A melanoma is a skin cancer of pigment-producing cells called melanocytes. Though a melanoma can be alarming, being aware of the definitive signs of this skin cancer can encourage those affected to seek out medical consultation from a dermatologist. In Southern New Mexico, community health workers known as 'promotoras' provide basic health education, especially in areas of low-income or predominantly Spanish-speaking individuals, serving as a liaison between the layman and a physician. This project aims to use the presence and influence of promotoras to recognize suspicious lesions and advise potentially affected community members to visit a dermatologist.

Methods: To gauge the ability of promotoras to effectively recognize suspicious lesions, this study will involve a 10 question quiz, administered via Google Forms, asking whether or not each photo of a skin lesion is suspicious. Following completion, participants will be instructed to read an educational flier about the "ABCDEs" of melanoma, highlighting warning signs and illustrating associated pictures. Participants will then be asked to take a follow-up quiz with similar questions to the first quiz.
This study also aims to measure the confidence of promotoras in both recognizing suspicious skin lesions and speaking to community members after discovery. Participants will be asked to rate their confidence in each of these categories before and after reading the educational flier.

Results: Optimal results for this study would demonstrate a significant improvement in performance between the pre-flier and post-flier quiz results and/or confidence in recognition abilities and speaking to community members. The improvement in quiz scores will demonstrate an association between a baseline understanding of the warning signs of melanoma with the educational flier.

Conclusion: This study hopes to show the potential application of melanoma education and promotoras in improving community health, particularly skin cancer identification and prevention in the Southern New Mexico community.

P5. Mindfulness as a Potential Protective Behavior Against Stress-Associated Vision Loss
Jeffrey S. Briggs
Mentor: Kristin L. Gosselink

Objective: Age-related decline in visual function is influenced by various factors, with certain populations being more susceptible to early vision loss. Prolonged psychological stress may exacerbate the risk of early visual decline. This study aims to evaluate the correlation between stress levels, coping strategies, risk factors, and vision-related symptoms in individuals from the Paso del Norte region, focusing on an age group typically not yet expected to experience age-related visual decline.

Methods: Participants were recruited through in-person communication and flyer distribution, primarily at optometry offices, and directed to a QR code or URL for survey entry. We aimed to recruit 125 participants, based on a review of similar studies. The 88-item online survey, constructed using the Qualtrics XM platform, adapted validated instruments assessing stress exposure, mindfulness, lifestyle, stress-coping, and visual function. These included the FANTASTIC Lifestyle Checklist, 15-item Five Facet Mindfulness Questionnaire (FFMQ-15), 10-item Perceived Stress Scale (PSS-10), Stress and Adversity Inventory for Adults (Adult STRAIN), and the National Eye Institute 25-item Visual Function Questionnaire (VFQ-25). Duplicate questions across instruments were identified by screening through an artificial intelligence platform and, where possible, removed to reduce participant burden. In some cases, qualitative survey responses were coded as numeric values to allow for quantitative analysis and comparison. Data were analyzed for normality using the Shapiro-Wilk test, and a multivariable correlation matrix was performed using Prism GraphPad, with significance determined at $p \leq 0.05$.

Results: As of July 21st, 43 participants had completed the survey. Of these, 70% identified as female; the majority identified as Hispanic or Latino/a/x (58%), followed by White/Caucasian (38%), and American Indian/Native American (5%). More than 72% of participants reported engaging in some form of stress coping at least "some of the time" or "fairly often," with exercise being the most common coping method employed (74%). VFQ-25 results did not pass the Shapiro-Wilk test for normality ($p < 0.001$); however, all other results passed ($p > 0.05$). Correlations were assessed using a nonparametric multivariate correlation matrix, generating Spearman's rank correlation coefficients. Significant correlations were found between the FANTASTIC scale and FFMQ-15 ($r_S = 0.598$, $p < 0.0001$), PSS-10 ($r_S = -0.828$, $p < 0.0001$), and VFQ-25 ($r_S = 0.462$, $p = 0.002$) responses. Additional correlations were seen between FFMQ-15 and PSS-10 ($r_S = -0.638$, $p < 0.0001$), and PSS-10 and VFQ-25 ($r_S = -0.318$, $p < 0.037$). Correlations between VFQ-25, FFMQ-15, and Adult STRAIN were insignificant ($r_S \approx 0$, $p > 0.05$).

Conclusion: The number of participants surveyed is below the 125-participant threshold estimated for sufficient power (80%) in this study, which is ongoing and may ultimately produce greater or different results. Preliminary data suggest a relationship between perceived stress, lifestyle, and visual function, in line with prior observations in the field. Participants generally reported good health, few lifetime stressors, and regular engagement in stress-coping, particularly exercise. These findings were somewhat surprising as the Paso del Norte region is often assumed to provide a stressful environment for a too-sedentary community. No significant relationships were found between cumulative lifetime stress, mindfulness, and visual function. However, moderate correlations between perceived stress, lifestyle, and visual function suggest that higher perceived stress may be linked to impairments in visual function.

P6. Assessing and Improving Healthcare Provider Knowledge About HPV and the HPV Vaccine to Promote Vaccine Uptake

Malia Gonzales*, Radha Patel*, Katie LaRoche, Nancy Somo, and Aislin Sullivan
Mentor: Kristin L. Gosselink

Objective: Vaccine uptake tends to increase following healthcare provider recommendations for that vaccine, yet provider recommendation behaviors vary and can be influenced by provider knowledge and beliefs. The goal of this study was to determine if provider intervention would increase HPV vaccine recommendations and uptake to prevent future occurrences of HPV-associated cancers in the Paso del Norte region.

Methods: Healthcare providers in practice or in training, including physicians, physician assistants, pharmacists, nurses, and nurse practitioners were recruited from El Paso County, Texas, and Southern New Mexico. Providers were randomly sorted into experimental and control groupsand invited to complete an online intervention and survey. Both groups had 3 components to their intervention – a "read it" PDF file to read, a "watch it" video to watch, and a "do it" series of 4 rank-order multiple-choice questions to answer. The providers were then sent a survey with 171 questions on their HPV and vaccine knowledge, attitudes and practices. Recruitment was accomplished by handing out flyers and in-person and electronic communication. Responses were collected and de-identified through the REDCap platform, which was also used to send 3- and 6-month follow-up surveys to evaluate changes in behavior and the persistence of those changes. Participants were compensated with a $30 gift card for completing the intervention and initial survey, and a $10 gift card for each of the follow-up surveys. Qualitative data were evaluated descriptively or converted to numeric data using a series of codes (ex: Unsure (1), False (2), Somewhat (3), True (4)) for quantitative comparison Data were analyzed using Excel, SPSS, and R. T-tests were performed to determine statistical significance, with a p-value of ≤0.05 considered significant. Institutional Review Board approval was secured ahead of any participant recruitment or engagement.

Results: The initial survey had 128 provider responses. Multiple specialties were represented within the subset of physicians, including Family Medicine, Pediatrics, and ObGyn. Our sample population was 65% female and 51% Hispanic or Latino/a, with 55% of the participants in training as compared to 45% in practice. We found significant differences in providers' understanding of dosing and eligibility guidelines for the HPV vaccine, and the experimental intervention increased this understanding. Providers in practice and older than 35 years of age seem to have a better understanding of current guidelines. Pharmacists and pediatricians also demonstrate higher knowledge regarding HPV vaccine guidelines. Regarding vaccine recommendation practices, providers recommend the HPV vaccine more often to their patients who are

less than 26 years of age than they do to patients aged 27-45 years. Compared to physicians specializing in internal medicine and family medicine, pediatricians more often expressed that they recommend the HPV vaccine equally to their male and female patients. Early partial analysis of the 3-month follow-up data suggests an increase in HPV vaccination recommendations from providers participating in the study. We are currently collecting the 6-month follow-up data.

Conclusion: We have identified a number of areas for intervention and improvement to increase or strengthen provider recommendations for the HPV vaccine and communication with patients. More analysis will be completed as the data from the 3- and 6-month surveys are received. Future directions include developing a better educational curriculum for providers regarding HPV vaccination. The study's limitations include a smaller sample size and low retention of providers completing the follow-up surveys. Expanding the study to more of New Mexico in the future may improve the sample size limitation.

*Authors contributed equally to the work

P7. Cancer Prevention: Impact of Healthcare Provider Intervention on Communication About HPV and the HPV Vaccine in El Paso County and Southern NM
Nancy J. Somo*, Aislin Sullivan*, Katie LaRoche, Malia Gonzales, and Radha Patel
Mentor: Kristin L. Gosselink

Objective: Human papillomavirus (HPV) was recently identified as the leading infectious cause of cancer in the United States1. The HPV vaccine can prevent most of these cancers when given as recommended2, but only 58.5% of Texas 13-17 year olds were up-to-date in 20223, compared to 62.6% nationally4. As previous studies linked strong provider recommendations with HPV vaccine uptake5, the goal of this study was to impact provider communication and vaccine recommendations through tailored intervention.

Methods: Current (in practice) and emerging (in training) healthcare providers were enrolled from El Paso County, TX and Southern NM. Recruited participants included physicians, pharmacists, dentists, nurse practitioners, physician assistants, nurses, and students who were on their clinical rotations. After informed consent was obtained, participants were randomly sorted into control or experimental groups, with each group having three components to their respective intervention. Participants from both groups read a document, watched a video, and completed a series of four rank-order questions. The control intervention focused on general strategies for improving communication. In contrast, the experimental intervention focused specifically on improving patient-provider communication, and it also contained pertinent information regarding HPV and the HPV vaccine. Following the intervention (approx. 10 minutes in length), participants completed an anonymous online survey which was distributed through RedCap. This survey addressed provider knowledge regarding HPV and its cancer association, factors of vaccine hesitancy, various communication styles, and the role of a provider's recommendation with respect to vaccine uptake. Data analysis was performed on the initial survey responses using Microsoft Excel, SPSS, and R. Statistical analysis by t-test was conducted with p≤0.05 considered significant. Follow up surveys were delivered at 3-months and will be delivered at 6-months following the intervention and initial survey.

Results: A total of 128 complete survey responses (70 Control, 58 Experimental) were collected from providers (age 34 ± 1 year) within the Paso del Norte region. Participants self-identified evenly as in-practice vs. in-training and Hispanic vs. non-Hispanic, but 65% identified as female. Provider comfort level when discussing HPV and matters related to sexual health was significantly different between control and experimental groups (p=0.03). Additionally, a trend was observed based on provider gender, with male providers having a slightly higher comfort level (p=0.09). Comfort level with youth/adolescent and adult counseling varied, with in-practice providers demonstrating a higher level of comfort for both (p=0.00 and p=0.02, respectively). Similarly, providers aged 35 or older demonstrated a significantly higher (p=0.01) comfort level with youth/adolescent counseling (p=0.01).

Providers were much more likely to recommend other non-required vaccines (COVID-19, flu, etc.) than the HPV vaccine (p=0.00). Providers in the experimental intervention group rated their non-required vaccine and HPV vaccine recommendations more strongly than providers in the control group; however, only the non-required vaccine recommendations were significantly different (p=0.05 for other non-required vaccines, p=0.26 for HPV). A statistical difference was also observed with respect to provider gender, with male providers recommending other non-required vaccines at a higher rate (p=0.04). Provider specialty impacted behavior. Internal medicine had the lowest comfort discussing HPV and sexual health vs. pediatrics (p=0.00) and Ob/Gyn (p=0.00) and the lowest comfort with sexual and/or reproductive health counseling for youth vs. Ob/Gyn (p=0.00) and family medicine (p=0.04). Internal medicine providers also had lower HPV vaccine recommendation rates than pediatricians (p=0.03) and lower comfort with sexual and/or reproductive health counseling for adults vs. Ob/Gyn or family medicine (p=0.00 for both).

Conclusion: Prior data from this project, utilizing a similar provider survey, revealed that participants had strong HPV knowledge and positive perceptions of HPV vaccine safety and efficacy with low levels of vaccine hesitancy. Provider perceptions were not affected by gender, political affiliation, family structure, or ethnic identity. These findings were replicated in the current study.

Our data illustrated that the most frequently reported barriers to vaccine uptake, from the provider perspective, were vaccine hesitancy of the patient or guardian, cost/insurance coverage, limited amount of time that providers have with their patients, and the fact that the HPV vaccine is only recommended and not required. Vaccine hesitancy of the patient or guardian was the highest ranked barrier; therefore, providers should use this as a communication opportunity to address concerns effectively. Additionally, despite other studies showing the importance of a strong provider recommendation with regard to vaccine uptake, the providers surveyed here ranked "provide a strong recommendation for the vaccine to the patient/parent" as the least likely action on their part to succeed in addressing vaccine hesitancy. It is thus imperative to explain to providers that their recommendation plays an important role in vaccine uptake in order to prevent future occurrences of HPV-associated cancers.

Initial analysis of 3-month follow-up survey data suggests that providers from the experimental group are more comfortable speaking about HPV and communicate more strongly or more often about HPV since participating in the study. Further analysis of these data and 6-month follow-up data are pending.

*Authors contributed equally to the work.

References:
1. Islami F, Marlow EC, Thomson B, et al. Proportion and number of cancer cases and deaths attributable to potentially modifiable risk factors in the United States, 2019. CA Cancer J Clin. 2024; 1-28. doi:10.3322/caac.21858
2. https://www.cancer.org/cancer/risk-prevention/hpv/hpv-and-cancer-info.html

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4. Pingali C, Yankey D, Elam-Evans LD, et al. Vaccination Coverage Among Adolescents Aged 13–17 Years — National Immunization Survey–Teen, United States, 2022. MMWR Morb Mortal Wkly Rep 2023;72:912–919. DOI: http://dx.doi.org/10.15585/mmwr.mm7234a3.

5. Oh NL, Biddell CB, Rhodes BE, Brewer NT. Provider communication and HPV vaccine uptake: A meta-analysis and systematic review. Prev Med. 2021 Jul;148:106554. doi: 10.1016/j.ypmed.2021.106554. Epub 2021 Apr 20. PMID: 33857561.

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P8. Validating Self-Management of Disease: Novel Patient-Driven Study Design Applied to Paroxysmal Atrial Fibrillation

Alexander T. Morris, Joe Brinza
Mentor: Harald M. Stauss

Objective: The objective of this study is to identify self-management strategies used by patients to terminate paroxysmal atrial fibrillation (AF) episodes in their home setting. Our long-term goals are to classify such strategies based on estimated effectiveness, potential mechanisms, and safety profiles. Ultimately, this research may lead to the discovery of novel, effective, and safe self-management strategies patients can use in their home setting to convert paroxysmal AF to sinus rhythm.

Methods: We utilized a community-based participatory research (CBPR) approach leveraging the online presence and practical experience of patients in AF support groups. Our study design is sequenced into four stages: (1) Identify and establish collaborative relationships with support groups leaders. (2) Collaboratively develop and distribute a questionnaire to identify paroxysmal AF self-management strategies and their self-reported effectiveness. (3) Identify the most promising self-management strategies based on their estimated effectiveness. (4) Conducting a clinical trial to validate efficacy, safety, and to investigate the underlying mechanisms of action of the most promising self-management strategies identified by the survey study. For the first stage, potential AF support groups were identified. Inclusion criteria included moderator accessibility, an active online presence, and group demographics representative of patients with paroxysmal AF. Groups were excluded if they had limited online activity, a focus not specifically directed to AF, or if there were anticipated difficulties in administering a survey. A standardized email was drafted and sent to each group moderator communicating our research aims and inviting them to a Zoom meeting for a presentation and discussion of their potential involvement. In stage two, collaborating group moderators participated in the development of an online survey. Moderators presented the working draft to group members for feedback on question wording and scope. The Qualtrics questionnaire was iteratively updated until a final version of the survey was developed with no additional comments from support group moderators. Survey distribution among the social media groups is scheduled for early September 2024. Stages (3) and (4) will start once the responses from the Qualtrics survey have been received.

Results: 14 online support groups were identified as well as 22 local cardiology offices in the El Paso/Las Cruces region. None of the local cardiology offices were aware of AF support groups that met locally. The online support groups were identified by word of mouth from prior BCOM research initiatives and through internet searches including websites and chat servers. Of the 14 online support groups, four met

the exclusion criteria. The moderators of the remaining ten groups were contacted by email. Six moderators responded to the email and joined the researchers for a Zoom meeting and PowerPoint presentation detailing the research goals. Five of the groups agreed to collaborate. The sixth group conveyed interest and committed, pending internal discussion among their leadership. In collaboration with the groups and moderators, a 17-question survey was developed. The survey design included questions to address the following: paroxysmal AF diagnosis, AF frequency, time since diagnosis of AF, satisfaction with current treatment, current pharmacological interventions used, and an open-ended response section for a detailed methodology and self-reported efficacy of the self-managed technique(s) used to terminate AF. The survey was explicitly designed to omit patient-identifying information and, therefore, has been determined to be exempt from Institutional Review Board (IRB) review by the Burrell College IRB. Ultimately, the survey has the potential to reach over 43,000 members of five different online social media AF advocacy groups.

Conclusion: The CBPR-based methodology proved effective in establishing working relationships with moderators and members of online AF advocacy groups. This relationship resulted in the design of a survey aimed at developing an inventory of self-management strategies used by patients to convert paroxysmal AF episodes back to a normal sinus rhythm. The "grass root" approach promoted a collaborative environment with active participation by the AF advocacy group moderators and members. This collaborative environment was instrumental in improving the clarity of the survey questions and the appropriateness of survey response options. Based on the established collaborative environment, we expect a high survey response rate. It is reasonable to assume that the positive outcomes of our research study so far are at least partly due to motivating factors such as the shared interest in improving the quality of life of patients with AF.

P9. Role of Curcumin Nanoparticles in Abolishing Inflammatory Breast Cancer Emboli

Niketa. Dixit, Caitlin M. Blades, Weam Elbezanti, Kenneth L. van Golen
Mentor: Arun Kumar

Abstract
Inflammatory breast cancer (IBC) is the most lethal form of breast cancer, diagnosed in up to 6% of breast cancer cases and responsible for 10% of breast cancer deaths annually. Emboli formation, the hallmark of IBC, renders the tumor highly resistant to chemotherapy and promotes metastasis through the lymphatic system. Curcumin, a derivative of the spice cumin, is an effective anti-inflammatory with anti-tumor properties. Using nanoprecipitation, we developed coated and uncoated nanoparticle formulations of curcumin ("nanocurcumin"). This nano curcumin, plus standard whole curcumin, was used to treat SUM149 inflammatory breast cancer cell lines and emboli to determine the effects against IBC. Both curcumin and formulations of nanocurcumin significantly decreased cell density and increased apoptosis at 200 and 300 ng/mL, but not at 100 ng/mL. In cell proliferation assays, nano curcumin outperformed curcumin, with poly-lactic-co-glycolic acid (PLGA) coated nano curcumin significantly decreasing proliferation compared to non coated nano curcumin (20% decrease). When emboli formation was induced and subsequently treated with curcumin or nano curcumin, only the nano curcumin formations successfully dissociated the emboli, with the non

coated formulation decreasing emboli mass by 20% and coated nano curcumin destroying the emboli. Based on this data we believe PLGA-coated nanocurcumin is a new and highly efficient potential therapy for IBC.

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P10. Anti-inflammatory effects of occipitoatlantal decompression and transcutaneous auricular vagus nerve stimulation
Arsany Farid, and Komal Khokhar
Mentor: Harald M. Stauss

Objective: Activation of the vagus nerve can induce anti-inflammatory pathways, which can play a crucial role in treating chronic inflammatory diseases. This activation shifts the function of immune cells in reticular organs, such as the spleen, from a pro-inflammatory to an anti-inflammatory state. These cells subsequently migrate into the systemic circulation to reach sites of inflammation, exerting anti-inflammatory effects by reducing the levels of pro-inflammatory cytokines or increasing the levels of anti-inflammatory cytokines. Previous research has demonstrated evidence of activation of the vagus nerve through methods such as transcutaneous auricular vagus nerve stimulation (taVNS) and occipitoatlantal decompression (OAD).

Methods: In this study, adult and generally healthy study participants underwent interventions administered over four sessions, with all sessions separated by a minimum of one month. Each session comprised three consecutive study days during which the same interventions were repeated. Subjects were randomized into one of three experimental groups. Baseline recordings of hemodynamic parameters were obtained for all groups prior to any intervention. The first group received either OAD or sham-OAD. The second group received either taVNS or sham-taVNS. The third group served as a time control, undergoing the setup for treatment without receiving any intervention. Following the initial interventions, post-intervention recordings of hemodynamic parameters were taken for all groups. Subsequently, patients in the first and second groups received a second intervention consisting of either a splenic pump (SP) treatment or a sham-SP treatment, while the third group continued to serve as a time control without intervention. Post-intervention recordings were taken again for all groups after the second intervention. At the conclusion of the third treatment day, blood samples were taken from the subjects. Plasma was stored at -80°C and leukocytes were cultured in the presence or absence of various Toll-Like Receptor (TLR) agonists (TLR 2, 3, 4, 5, 7/8, and 9). Cell culture supernatants were collected 24 hours later for further analysis. Bioplex assay kits (Bio-Plex Pro Human Cytokine 8-plex Assay #M50000007A, Bio-Rad, Hercules, CA) were utilized on selected plasma and cell culture samples to assess the levels of various inflammatory markers. Due to funding constraints, we were limited to only analyze select samples. To minimize the effect of confounding factors, we selected samples from study participants with matching ages and body mass indices (BMI).

Results: The cytokines analyzed included: GM-CSF, IFN-γ, IL-2, IL-4, IL-6, IL-8, IL-10, and TNF-α. For the plasma samples, only TNF-α, IL-6, and IL-8 were within detectable limits of the

BioPlex assay. Independent measures ANOVA revealed a trend for lower IL-8 plasma levels in subjects who received taVNS (2.9±0.3 pg/mL) compared to control subjects (5.0±0.9 pg/mL, P=0.06). Plasma TNF-α levels were significantly lower in subjects who received taVNS (8.5±1.8 pg/mL, P<0.05) and OAD (9.4±1.5 pg/mL, P<0.05) compared to control subjects (14.3±1.9 pg/mL). Cytokine levels in cell culture supernatant from cells that were not stimulated by TLR agonists were generally below the detection threshold of the BioPlex assay. It is important to note that cell culture supernatant samples were used without dilution. In contrast, cytokine levels in cell culture supernatant from cells stimulated with the TLR 2 agonist lipoteichoic acid were generally above the upper limit of the detection range of the BioPlex assay, preventing us from conducting meaningful statistical analyses.

Conclusions: OAD and taVNS demonstrated anti-inflammatory effects, as evidenced by the reduction in plasma TNF-α levels. This effect of OAD and taVNS on TNF-α is clinically significant given that TNF-α is a key cytokine targeted by numerous biologic drugs used in various chronic inflammatory diseases, such as psoriasis, inflammatory bowel disease, or rheumatoid arthritis. The BioPlex assay is not sensitive enough to detect spontaneous cytokine release from non-stimulated cultured leukocytes from healthy study participants. The extreme high levels of cytokines in cell culture supernatant from TLR 2-stimulated cells suggest that cells were maximally stimulated. In future studies, it is advisable, to generate dose-response curves for the effect of TLR agonists on cytokine release from cultured leukocytes. Furthermore, it may be necessary to dilute the samples before analysis.

P11. Short-Lever Assessment of Spinal Side-Bending
Fatima Khalil, Matthew McClendon, Kaili Sudweeks
Mentor: Adrienne Kania

Objective: The primary objective of this study was to determine if the lumbar and thoracic spines moved into side-bending when the short-lever side-bending technique was applied. The secondary objective was to determine how much force is required to create side-bending of these regions. Results were compared to successful movement noted on ultrasound imaging while employing the long lever method of side-bending.

Methodology: This study included two phases of evaluation: blinded and unblinded. Subjects were evaluated lying prone on a table while the physician participants identified four specific vertebral segments. Evaluated segments included one "normal" vertebra and one vertebra with a Type 2 somatic dysfunction in both the thoracic and the lumbar spines. A Type 2 somatic dysfunction describes a single vertebra that exhibits asymmetry in flexion or extension due to the shortened, hypertonic muscles of the spine. These dysfunctions also cause limited motion in side-bending and rotation in the same direction. The physician participant translated each vertebra at least once in each direction according to the instructions listed in the "Atlas of Osteopathic Techniques" by Drs. Nicholas. A student ultrasonographer placed the transducer in a longitudinal view on the tips of the transverse processes on one side. The physician participant translated the vertebra being evaluated towards the transducer during each attempt to move the segment into side bending. Two student researchers viewed the ultrasound monitor and documented any increase in space

between the transverse process of interest and the transverse process of the segment below. After each translation attempt, the physician transitioned to the loadpad sensors on the table and replicated their translational force. The physician was not permitted to view the ultrasound monitor during this phase of the evaluation (blinded). This process was repeated in the unblinded phase with the only difference being that the physician was allowed to view the ultrasound monitor during evaluation of the same vertebral segments. The physician participants completed a total of 16 translation attempts total.

Results: The study involved 12 osteopathic physician participants who regularly practice osteopathic manipulation with experience ranging from 2 to 36 years in practice. Of the 192 total translation attempts, only 13 successfully induced side-bending of the vertebra. The number of successful attempts varied among physician participants from 0 to 5 out of 16 attempts. There were 7 successes with normal vertebrae and 6 with dysfunctional vertebrae. Successes were noted 5 times with right translations and 8 times with left translations. Additionally, there were 6 successful attempts in the lumbar region and 7 in the thoracic region. The thumb pressures applied during successful attempts ranged from 14 newtons to 117 newtons. There were 7 successful attempts in the blinded phase and 6 in the unblinded phase. Overall, the effectiveness of the short lever approach did not vary significantly with factors such as physician experience, or direction of translation. These findings indicate variability in success rates and force application without clear patterns.

Conclusions: In this study, none of the 12 physician participants were able to consistently induce notable vertebral movement using the short lever approach on ultrasound imaging. The range of successful attempts varied significantly, from 0 to 5 out of 16 attempts, and there was no consistent pattern of success that could be reliably replicated. Due to the lack of consistently positive results, we interpret the few successful attempts as likely being due to chance rather than a repeatable outcome. Several limitations of the study impacted our findings: imperfect image collection, ultrasound probe placement that impeded physician finger placement, and varying levels of physician knowledge of ultrasound interpretation. All of these reasons contributed to the challenges faced. Additionally, anatomical differences among subjects, such as variations in joint and muscle laxity, may have further influenced the results. The short lever technique, originally formulated using cadaver tissue, appears to achieve a different level of success when applied to living tissue, suggesting that the same efficacy observed in cadaver studies may not be realized in practice. Furthermore, no correlation was found between successful attempts and the direction of side bending into the assigned ease for the segments.

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P12. Investigating the Efficacy of OMT to Recover Olfactory Perception After COVID
Sahej Dodd and Ranya Aziz
Mentors: Adrienne Kania and Thomas Eiting

Objective: The purpose of this project is to determine if OMT can be used to improve the loss of smell (anosmia) due to COVID. Testing the efficacy of the nasal Chapman point with OA release. A secondary objective is to see how long it takes for the improvement to occur. A third objective of this study is to determine how long the improvement in the sense of smell lasts.

Methods: Participants will be initially contacted via telephone to complete a pre-screening survey, which will be recorded into a Qualtrics survey to determine eligibility. Exclusion criteria include the use of zinc nasal spray, CPAP, or other sleep devices will be informed that they must avoid antihistamines for at least five days before participating. Eligible participants will be randomized. Participants will be required to sign an informed consent form before proceeding. A baseline olfactory function test will be conducted using the Sniffin Sticks test. Participants will be asked to identify odors from 16 different scented pens. Participants will be instructed not to eat, drink (except water), or smoke for at least 30 minutes before the test. If participants are unable to identify a scent, they will be instructed to select a response from identification cards. The absence of odor detection will be recorded. For both the OMT intervention and control groups, tenderness at anterior Chapman's points will be assessed as well as occipitoatlantal (OA) diagnosis will be performed. OMT intervention group will be treated with OA decompression lasting 2 minutes using 8N of pressure. Immediately followed by treatment of Chapman nasal sinus anterior point for 30 seconds on each side. They will be instructed to wait in the clinic for one-hour post-treatment and will be allowed to walk around and drink water but will be restricted from consuming any food or other beverages. Control group participants will be positioned supine while the investigator gently places their hands on both sides of the neck for 5 minutes. After the one-hour waiting period, participants will undergo a second Sniffin Sticks test using the opposite version of the test. Participants will be instructed to return to the clinic within 24-48 hours for a third Sniffin Sticks test, using either the purple or blue version, selected randomly to prevent memorization of the odor sequence. All results from the Sniffin Sticks tests will be recorded and analyzed to assess changes in olfactory function between the pre-treatment, post-treatment, and follow-up tests. Using 2-sided t-tests, pre- and post-intervention olfactory scores will be compared in the same age groups.

Preparation: When obtaining subjects for this study, an ad will be sent out to entice more subjects to participate. This was sent for IRB proposal in June. In order to prepare for the study, the investigators need to apply the same amount of pressure on every subject while performing the OA decompression portion of the treatment. The set amount of pressure needed for OA decompression was determined to be 8 Newtons. The investigators used calibrated force plates to learn how to apply the 8 Newtons of pressure, so it was standardized for each patient and is not a confounding factor. As students, learning many OMT techniques throughout the first year of medical school helped us fine-tune our palpatory skills allowing us to maintain a certain pressure for the duration of a treatment.

Conclusion: As our research has not been finished, we have no conclusive evidence. We expect to see that the OA decompression and anterior nasal Chapman points yield positive results meaning there is improvement in their olfactory sensation. To do this, we would continue by recruiting subjects for the study to get data so we can conclude this study.

P13. Digital Surgery of Nasal Airways
Samantha Lester, Simran Bhakta, LaShay Taylor, Alexis Fastle
Mentor: Thomas Eiting

Objective: Digital surgery is the process of utilizing three-dimensional models created through computer software based on patient computed tomography (CT) imaging. The purpose of digital

surgery is to project outcomes after a digital surgical "procedure," thus eliminating the need to perform physical surgery on a patient in order to observe potential effects. This process can be predictive for individual patients prior to undergoing a real surgery or can be used to generate data about the efficacy of a procedure by changing specific parameters including aspects of this study: inspirational air flow velocity, force, temperature, humidity, or changes in olfaction.

Methods: Using anonymized publicly available CT scans of nasal airways, we constructed 3D digital models of the nasal passageways. The selection of acceptable CT scans from a collection of 490 was determined by the presence of clear nasal anatomy and the absence of medical instruments such as nasogastric tubes. 17 scans were chosen to be further evaluated based on the stated criteria as well as the presence of anatomical variations/pathologies that make candidates for digital surgeries. Slicer software was used to isolate the nasal passages from the CT scans and create a 3D model which was then further refined in the program Geomagic. These models can then be put through computational fluid dynamics (CFD) analysis, measuring variables related to our specific research questions such as volume, temperature, or inspirational air velocity. The next step involves performing "digital surgery" to modify the three dimensional models, simulating a corrective surgical procedure. This will be followed by repeating CFD and assessing for changes in airflow variables.

Results: Once the models have been run through CFD, data regarding the specific parameters that each research question focuses on will be generated. This data will undergo statistical analysis using commonly available statistics software.

Conclusion: Once data is available and analyzed, conclusions may be drawn regarding individual research questions. Efficacy of the particular digital surgeries can be measured from comparing the "preoperative" and "postoperative" models.

P14. CT scan and 3D modeling reveals hidden features of fossil mammals from Palm Park, New Mexico
Alex Barrera, Janie Williamson, Steven Zhao
Mentor: Spencer Mattingly

Objective: Fossils of the late Eocene period have been found in the Palm Park formation of Sierra County, New Mexico. Genera that have been identified at the site include predominantly ungulate. Recently, numerous additional specimens were discovered from exposures near the southern Caballo mountains. Of these specimens, three were examined in greater detail due to their completeness, diagnostic, and anatomical significance. These included an ungulate petrosal bone, mammalian distal femur, and maxillary jaw fragment containing M1-M3. The goal of the study was to compare our human anatomy knowledge to the fossils to determine fossil anatomy, function, and taxonomic identification.

Methods: Criteria for choosing our three specimens were based on size and our ability to identify the specimen on a taxonomic and anatomical level. Many of the other specimens were too small or fragmented to properly identify and compare anatomy and function. Materials used for this study included

the specimens themselves, a light microscope, a magnifying glass, calipers, *3D Slicer program*, and a CT scanner at the Imaging Center of Las Cruces. To facilitate our anatomy comparisons, we used prior literature concerned with relevant mammalian anatomy/morphology. Current mammal models were utilized to help determine primary function of anatomical features and influence our hypotheses of the organism's habitat, diet, and size. Key identifiable features of the specimens, based off human anatomy knowledge, were used to compare evolution processes of species. CT scans were used to visualize potential structures inside the fossilized matrix not visible to the human eye. After receiving these results, we used *3D Slicer* to create digital 3D models of structures like growth plates and semicircular canals that were revealed with the CT imaging.

Results: Based on literature review analysis and human anatomy comparison knowledge, several hypotheses were developed for taxonomic identification, morphological function, size, and diet. First, we used a light microscope to analyze the petrosal bone. Structures visible to the human eye included many foramina, such as the fenestra vestibuli (oval window) and the secondary facial foramen, and a potential grooved route for chorda tympani branching off the facial nerve. The medial part of the petrosal bone is preserved and enclosed within it, fragmentary portions of the bony labyrinth. Based on the orientation of chorda tympani and the secondary facial foramen, we determined that our specimen is a left ear, potentially belonging to an artiodactyl ungulate. We CT scanned the petrosal specimen to visualize the inner ear structures still present inside the rock fossil and were able to visualize at least one semicircular canal. Due to the distal femur's asymmetry, specific landmarks led us to believe that there were functions that differ from that of humans. The posterior aspect of the distal femur, the medial condyle seems smaller compared to the lateral condyle: however, despite the size of the medial condyle still protrudes relatively far from an anterior view. Previous suggestions of an asymmetrical femur function are that they are designed for animals to have preferred type of locomotion such as a gallop gait for their habitat. Based off the evidence of literature review and the use of comparative human anatomy knowledge, the hypothesis of the species is that it could be a distant relative of the *Antilocapra American*. Based on the orientation of the three left molars M1,M2, M3, it was determined that these molars were from the maxilla. Since the maxillary bone was split into two pieces, we were able to see the roots and the size of them. We were then able to use literature that has been published to compare the features of the molars to determine function and taxonomic identification taxon. The buccal side of the teeth have a larger and robust set of roots relative to the lingual root. The molars are hypsodont due to their high crowns. The teeth have a crescent shaped cusp, which is consistent with selenodont teeth. These types of teeth are found in mammalian herbivores, more specifically an artiodactyl ungulate or hooved animal. Artiodactyl ungulates have a W-shaped ectoloph which is what this specimen has. By identifying what type of teeth they are, we can infer this animal had a plant diet. We can also speculate that this mammal also had an anatomical and physiological gastrointestinal system capable of processing plant tissue. The animal should have been able to obtain its nutrients and survive based upon the plants around the area.

Conclusion: After the collection of several specimens, we were able to select a few specimens to study. These included a petrosal bone, a mammalian distal femur, and maxillary jaw fragment containing M1-M3. We hypothesize the petrosal bone is from an artiodactyl ungulate based on its anatomy in comparison with other ungulates. The femur is believed to be distant relative of the *Antilocapra American, a*n animal that had a gallop gait. From this we can conclude that it lived in an environment that allowed for galloping, such as open land or plains. The Maxilla is believed to be from an artiodactyl ungulate or hooved animal. Based on the molars, it is an animal that had an herbivore diet. This means the habitat it lived in needed to have an abundance of suitable plant material. In the future, we can collect more specimens in southern New

Mexico to determine what other species lived here several million years ago. We also plan to continue our investigation of the three specimens we worked with this summer. The femur includes a growth plate, indicating that it may have been from a young animal. Further investigation of this growth plate could give us even more details on its species. We can also determine dimensions of the inner ear of the petrosal bone to assess locomotor agility. Further investigations in this field would not only benefit our understanding of mammals of the Eocene Epoch but also further solidify our comparative anatomy skills as we proceed through medical school.

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P15. Traumatically Induced Holmes Tremor with Neuroanatomic Correlation and Video Documentation

Ridhika Prasad, Dalia Gazallo
Mentor: Robert Coni

Objective: Gordon Holmes in 1904 described a series of patients with focal midbrain lesions who exhibited a coarse tremor, now called rubral tremor because of dentatorubrothalamic pathway damage.[6] We present a 53-year-old woman who had closed head injury (CHI) at age 6 and after developing a left sided, 4 hz course resting and action tremor responsive partly to levodopa therapy. We present video of the movement disorder as well as MRI confirmation of a lesion in the right thalamus.

Methods: The patient was seen to establish local neurologic care. This 51-year-old, right-handed, woman had a diagnosis of "essential tremor with parkinsonian features." She took primidone, 50 mg daily and carbidopa-levodopa intermittently. Her tremor affected the left side of her body and had been present since the age of 6. The tremor began after CHI. The patient recalls being struck in the head, and falling with a loss of consciousness but does not recall more detail. After the fall there was a feeling of left sided "numbness" and she noted "difficulty" with motor control which evolved into persistent tremor. A few weeks after the fall, a physician felt her left weakness was likely a conversion reaction. We have no records. At age 26, a brain MRI was done demonstrating small Rt thalamic T2 and T1 lesions, appearing infarct like. A repeat MRI study done in 2022, redemonstrates these unchanged thalamic lesions. The patient is a dental hygienist and takes 5-6 c-dopa-l-dopa, 25/100 mg tablets, at work to control the tremor. Tremor can be mitigated by bracing her arm at her side as she bends to work in a patient's mouth. Serum ceruloplasmin and copper levels were normal upon testing. Holmes correlated the tremor with damage to the red nucleus or cerebello-rubral system, linked to the thalamencephalon. Thalamic lesions can cause high-amplitude, low-frequency tremors, highlighting the thalamic role in the "long loop" pathway. Other areas like the red nucleus, globus pallidus, and cerebellum are sometimes also involved. The role of the nigrostriatal pathway is speculative, based on the tremor's levodopa responsiveness[1]. Holmes tremor is a low-frequency tremor (2-4 Hz) with high amplitude, typically present at rest, with movement, or when holding a position[6]. In contrast, essential tremor ranges from 6-12 Hz and affects various body parts. Cerebellar tremor is also low frequency (<5 Hz) but occurs mainly during voluntary aiming movements or when maintaining posture[2].

Results: Two MRIs from ages 26 and 51 are presented. An unchanged Rt thalamic lesion is seen in both scans. T2 and T1 weighted images are shown as well as fluid-attenuated inversion recovery and susceptibility images. FLAIR images are useful to detect MS lesions. FLAIR images were done in the 2022

MRI but not 1997. They show unchanged T1 and 2 thalamic lesions without other FLAIR lesions to suggest MS. Susceptibility imaging would show evidence of old blood (from hemorrhage, AVM or cavernoma leakage) by total absence of signal producing a dark black ring or region. There was no evidence of heme in the tissues around the lesion or elsewhere. We also obtained ceruloplasmin and copper levels in serum. In individuals with movement disorders under age 55, an evaluation for spontaneous Wilson's disease is warranted. The assessment of ceruloplasmin, as well as serum and urinary copper levels, provides a reliable and sensitive means of excluding Wilson's disease. Wilson's disease is distinguished by a specific constellation of motor symptoms, including tremor[3]. It is fatal without treatment by chelation. The dentorubrothalamic pathway plays a crucial role in the development of Holmes tremor. It begins in the cerebellar dentate nucleus, with fibers traveling through the superior cerebellar peduncle and decussating in the midbrain red nucleus. Fibers then project to the ventrolateral (VL) nucleus of the thalamus (the location of our patient's lesion), which communicates with the motor cortex[2]. Holmes tremor typically emerges following damage particularly in the midbrain, where the dentorubrothalamic pathway is located. A double lesion theory has proposed damage in both the dopaminergic nigrostriatal system and the cerebellothalamocortical or dentatorubroolivary pathways is necessary to produce the tremor. The midbrain and thalamic lesions can lead to a disconnection between the cerebellum and the motor cortex, resulting in uncoordinated involuntary movements characterizing the tremor[4].

Conclusion: Presented is a case of Holmes tremor/rubral tremor. An accompanying video documents the classical features of the tremor which we have outlined. MRI scans which the patient has undergone are provided to demonstrate an appropriate lesion of the VL nucleus of the thalamus[5,7]. Historically the patient gives a history of trauma with weakness and numbness of the left side. The MRI images effectively exclude some other causes including tumor, vascular malformations, and labs exclude genetic or metabolic disease. Stroke and trauma are the most likely potential causes in this patient. Her history, albeit incomplete beyond the recollection of an adult at 6 yrs of age, suggests trauma. The case is presented to illustrate this rare movement disorder (less than 200 cases up to 2016 documented in the literature[6]), distinguish it from other common tremors and elucidate potential treatments. Levodopa therapy can be helpful as this case illustrates. Other treatments including thalamotomy of the ventral intermediate thalamic nucleus and deep brain stimulation have been used with some success. Stroke is deemed the most common cause of Holmes tremor and in this case though we cannot exclude stroke, her age at onset and the clinical circumstances suggest trauma was the etiology. The video presented clearly shows a Lt unilateral tremor (appropriate for a Rt thalamic lesion as the pathway is crossed), present at rest, enhanced with postural suspension, occurring at 3.7 Hz, and exacerbated with motor activation. These are all characteristics of Holmes tremor and can be used to differentiate this movement disorder from other tremors and movement abnormalities. MRI images: https://docs.google.com/presentation/d/1kkCZ0NqMj-JwXWDhE1EUl4-TV9TXC8Ez/edit?usp=drive_link&ouid=102205394068924801136&rtpof=true&sd=true
Video:
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P16. Gastroschisis
Priya Patel
Mentor: Richard Towbin

Abstract: Gastroschisis is a congenital anomaly characterized by extrusion of the intestines from the abdominal cavity through a defect in the abdominal wall. The condition is diagnosed prenatally by ultrasound and may present either as simple, with uncomplicated bowel, or complex with atresia and/or necrosis present. This case report reviews the recent literature on gastroschisis with respect to embryology, pathogenesis, prenatal diagnosis, management options, and patient outcomes. To reduce complications such as abdominal compartment syndrome and necrotizing enterocolitis, gastroschisis should be diagnosed early and the sequence of staged reduction operations should be initiated promptly. Assessment of the degree of intra-abdominal bowel dilation (IABD) by prenatal ultrasound is the most informative marker in predicting simple versus complex gastroschisis. The study concludes that a comprehensive understanding of gastroschisis including precise diagnostic markers and individualized treatment plans, is essential in managing patients with gastroschisis.

Abstracts – Oral Presentations

O1. Pulmonary Artery Aneurysm Secondary to Pulmonary Stenosis and Congenital Heart Disease
Brandon Cunningham
Mentor: Mohan Muvvala

Objective: This research examines the case of a 37-year-old Asian female with a pulmonary artery aneurysm, emphasizing the diagnostic and treatment challenges associated with this diagnosis. Despite numerous cases, there is no consensus on optimal management due to patient variability in age, sex, symptoms, aneurysm size, and recovery difficulties. This study specifically had the goal of determining treatment within a multidisciplinary team consisting of emergency medicine, cardiology, and family medicine.

Methods: This study is a case report that involved a comprehensive evaluation and management of a 37-year-old Korean female presenting with intermittent, non-exertional chest pain and left arm pain. Initial vital signs, physical examination, blood work, electrocardiogram (ECG), and imaging studies were performed to rule out emergent causes and diagnose the underlying condition. The subsequent diagnosis and treatment are studied and compared to similar case reports that have been published in medical journals in a thorough literature review.

Results: Vitals on admission to the emergency department for chest pain were notable only for a high blood pressure of 146/105, with a temperature of 97.2 F, a heart rate of 74 beats per minute, a respiratory rate of 18 breaths per minute, a 96% oxygen saturation on room air, and a body mass index (BMI) of 29. Initial blood work with troponins, complete blood count, complete metabolic panel, and a pregnancy test were all within the normal limits. On physical exam, she was noted to have a regular rate and rhythm without any apparent murmur, normal work of breathing, and a lack of any apparent neurological symptoms. She reported a history of a heart murmur since her early childhood, but had never had any associated symptoms. Electrocardiogram (ECG) showed left axis deviation, borderline T wave abnormalities, and baseline wander in leads III and AVF. A subsequent chest X-ray showed a possible enlargement of the main pulmonary artery. She was discharged from the ED as stable and referred to cardiology to perform an outpatient 2D echocardiogram. 2D echocardiogram was performed in the outpatient setting one month later and showed mild pulmonic stenosis with peak velocity of 2 m/s, trace pulmonic regurgitation, and dilation of the main pulmonary artery. A CT angiogram of the thorax showed focal fusiform dilatation extending from the pulmonic valve to the bifurcation, 5.5 cm in length, 3.8 cm mediolateral, and 4.5 cm anteroposterior. She was trialed on colchicine 0.6 mg daily due to the inspirational component of her chest pain, and referred to a congenital heart disease specialist. She reported some symptomatic improvement in her chest pain while taking colchicine. Subsequent follow up with the congenital heart disease specialist and her primary care provider led to a continuation of the same conservative management with colchicine, and recommendation for repeating an echocardiogram and CT angiogram in 6 months to monitor for changes in aneurysm size.

Conclusion: This case demonstrates promptly ruling out emergent causes of chest pain, accurately diagnosing rare causes of cardiac pathology via physical exam and imaging, and conservative, symptomatic management with plans for follow up and monitoring. This patient's cardiac pathology had gone undiagnosed for 37 years due to the rarity of this finding and the lack of symptoms. The most likely mechanism that caused this patient's pulmonary artery aneurysm and pulmonary stenosis is congenital

heart disease, especially due to the presence of a heart murmur since childhood. Congenital heart disease is the most common congenital anomaly associated with pulmonary artery aneurysm. There are multiple causes of pulmonary stenosis related to congenital heart disease, such as Noonan syndrome, though unlikely in our patient due to a lack of characteristic facial feature and skeletal abnormalities. Behcet's disease is also a known cause of pulmonary artery aneurysm, but was also unlikely in our patient due to absence of other mouth, skin, eye, joint, or gastrointestinal pathology. Infection with tuberculosis or syphilis, other common causes of pulmonary artery aneurysm, are also unlikely in this patient. Surgical intervention is an alternative management for patients with pulmonary artery aneurysms. Techniques like aneurysmorrhaphy, lobectomy, bilobectomy, aneurysmectomy, and pneumonectomy are documented in the literature. However, these procedures have a high risk of morbidity and mortality, particularly in patients with pulmonary hypertension. Though this patient did have a symptoms for a short period, the risks associated with a major cardiac surgery must be weighed against conservative treatment. This case further demonstrates the need for diagnostic criteria and treatment guidelines for individuals pulmonary artery aneurysms. Though future cases could be handled in this manner, more research is needed to decide whether to treat patients conservatively or with surgical interventions.

O2. Beyond PCR: The SHERLOCK Assay – A CRISPR/CAS-13 Based Method of Detection for West Nile Virus

Emily Kong
Mentor: Debra Bramblett

Objective: This study aims to develop and validate a rapid nucleic acid detection platform called SHERLOCK (Specific High-sensitivity Enzymatic Reporter Unlocking) for detecting West Nile Virus (WNV). SHERLOCK is a CRISPR-Cas-based assay that uses a crRNA guide to train a Cas13a enzyme to target specific DNA or RNA sequences. To evaluate its efficacy, we conducted proof-of-concept experiments and compared reactions at varied RNA concentrations. Additionally, we tested SHERLOCK's specificity to differentiate between WNV clades from the Southwest US and the original NY strain.

Methods: The SHERLOCK assay employs a two-step isothermal reaction (RT-RPA and Cas13 detection) that circumvents the need for thermocycling, unlike PCR, thereby enhancing its portability and suitability for point-of-care (POC) testing. Initially, WNV viral RNA is converted to DNA and amplified using reverse transcriptase recombinase polymerase amplification (RT-RPA) without cycling. The amplified DNA is then transcribed back into RNA for Cas13a-based detection, where the Cas13a enzyme, guided by a WNV-specific crRNA, selectively binds to the target sequence. Detection is achieved through a lateral flow assay (LFA), where the presence of the WNV target triggers reporter degradation, resulting in visual confirmation via test-line formation. To assess the sensitivity of the WNV-SHERLOCK assay, reactions were compared at varied WNV RNA concentrations. Specificity was assessed by introducing a single nucleotide alteration in the WNV-crRNA guide used for Cas13a detection. Negative controls were included using no-template controls (NTC) with ultra-pure water in place of viral RNA, while Zika virus served as a positive control, as previous studies validated a Zika-SHERLOCK assay. To prevent cross-contamination, the RT-RPA and Cas13 detection steps were conducted in separate areas.

RT-RPA Setup: Work areas were prepared with RNAase Zap, and all reactions were set up on ice. Master mixes were prepared for WNV 1:100 and Zika 1:100 with NTCs. Each mix included RPA primers, rehydration buffer, reverse transcriptase, and RNAse-free water, added to lyophilized DNA Twist pellets. RNA dilutions for each virus were added accordingly. Reactions were initiated with magnesium acetate and incubated for 25 minutes at 42°C with brief vortexing at 4 minutes.

Cas13-based Detection: Post-amplification, the crRNA for each virus was pre-incubated with Cas13a for 12 minutes. A master mix was prepared for each condition, containing ultra-pure nuclease-free water, HEPES, MgCl2, ribonucleoside triphosphates, RNase inhibitor, T7 RNA polymerase, and an LF-RNA reporter. The pre-incubated Cas13a-crRNA complex was added to the master mix. In a clean hood, RT-RPA products were transferred to the Cas13a mix and incubated at 37°C for 1 hour. Detection was performed using LFA strips, providing visual confirmation of WNV presence.

Results: We successfully detected WNV and Zika virus RNA using the SHERLOCK assay. Visual confirmation was obtained through lateral flow assay (LFA) strips, as positive results were indicated with a dark band across the test line. Serial dilution of the target RNA showed that we could detect as little as a 1:100,000 dilution of WNV RNA. Finally, we found that the SHERLOCK assay was not sensitive to a single nucleotide change in the crRNA guide. However, this suggests that our assay might have a more universal application in that it can detect more than one variant of WNV. Additionally, to demonstrate the specificity of the Cas13a detection, we introduced the WNV RPA products to the Zika crRNA, which served as our negative control. The results confirmed that the Zika crRNA did not cross-react with WNV RPA products, reinforcing the specificity of the guide crRNA.

Discussion/Conclusion: The SHERLOCK assay demonstrated high sensitivity in detecting WNV while distinguishing it from Zika virus. The SHERLOCK assay successfully detected WNV and Zika Virus compared to the no-template-controls and across serial dilutions for WNV to 1:100,000. However, the assay was unable to differentiate between the WNV clades from the Southwest US and original NY strain. The inability to differentiate between the strains could be attributed to the crRNA spacer sequence selection or potential contamination during the reaction setup, highlighting potential limitations in design. Further experiments are needed to examine a series of nucleotide modifications to learn more about the degree of CRISPR-CAS specificity. The results underscore the assay's potential for reliable POC diagnostics, despite some observed limitations related to contamination risk during the RT-RPA phase and the inherent instability of RNA and DNA. The SHERLOCK platform offers a promising alternative to PCR for POC testing, particularly in low-resource settings. Previous studies have used a demonstrated "one pot" detection of COVID-19 using SHERLOCK, demonstrating its potential for universal application for point of care testing. Its ability to rapidly and sensitively detect WNV demonstrates its potential for broader applications in viral surveillance. However, the study highlights the need for further optimization to reduce contamination risks and improve RNA/DNA stability. Despite these challenges, the SHERLOCK platform offers a promising alternative to current nucleic acid detection systems for diagnostic testing and viral surveillance. Future work will focus on developing a multiplex version of the SHERLOCK assay for simultaneous detection of multiple pathogens.

O3. Evaluation of GMSCs viability seeded on a moldable scaffold
Lato Nguyen, Andre Prieto
Mentor: Umadevi Kandalam

Objective: Craniofacial bone reconstruction has long been considered a complex procedure whose success depends on multiple factors including surgical technique, extent and location of bone defect, quality of adjacent tissues and choice of repair method. Stem cell-based technologies emerged as viable option to repair the complex defects. Transplantation of stem cells into a bone defect requires an extracellular matrix or scaffold in order to provide structure, promote adherence, cell proliferation and differentiation, and ultimately tissue repair. The objective of the study was to evaluate the cell viability of gingiva derived stem cells (GMSCs) embedded in a moldable scaffold material.

Methods: The cryopreserved GMSCs were cultured under standard culture conditions. GMSCs at 1×10^4 cells/well were plated in a 96 well plates. Sterile scaffold samples (0.3mg, 0.5mg and 1 mg/well) were placed in each well and incubated at 37°C with 5% CO_2 for 24, 48 and 72h. The cells without scaffold material is considered as control. The cytotoxic effect of the samples was assessed by determining the viability of GMSCs by a (WST) assay and a live dead cell assay

Results: The statistical analysis ANOVA was utilized to compare among the groups and treatment days. Our results showed that GMSCs were viable in demineralized bone matrix scaffold all concentrations. The GMSCs showed significantly high proliferation at 0.5 mg/10,000 cells concentration can have high proliferation. The results of live-dead cell assay showed similar effect.

Conclusion: The data demonstrated the DBM scaffold is compatible with GMSCs. At appropriate cell-scaffold ratio, this DBM material can be used for implantation in bone defect. Our results have translational value.

O4. Title: Association of pre- and poly-fluoroalkyl substances (PFAS) with depression in the US population: A cross-sectional study
Weston R. Stokey
Mentor: Humairat H. Rahman

Objective: Pre- and poly-fluoroalkyl substances (PFAS) are a fluorinated organic compound that are known as forever chemicals due to their high chemical stability. Common route of human exposure is environmental sources. Depression is associated with numerous other chronic diseases & affects an individual's activities of daily living. With the increasing exposure, this study set out to further establish a pathologic correlation of nine subtypes of PFAS with depression outcomes in the US adult population.

Methods: Depression ratings were based on individual responses to the Patient Health Questionnaire (PHQ9), and characterized as none with a score of 0-4, mild with a score of 5-9, moderate with a score of 10-14, moderately severe with a score of 15-19, and severe with a score of 20-27. PFAS exposure was analyzed from serum laboratory samples from the National Health and Nutrition Examination Survey (NHANES) data set. The following covariates were used in this study are: demographic data (gender,

ethnicity, marital status, education, age, family income to poverty ratio (FIPR), country of birth), body mass index (BMI), smoking, alcohol use, and physical activity, moderate, vigorous) from datasets compiled by the NHANES. The statistical analysis details three PFAS subtype levels ("Low", "Medium" and "High") based on their reported serum laboratory value analyzed from the NHANES datasets 2015-2016 and 2017-2018. By using quantile percentages (q), the variables below breakpoint 1 (b_1) and below breakpoint 2 (b_2) were constrained $0 \leq b_1$ and $b_2 \leq 1.0$. A low PFAS subtype concentration rage is defined as the quantile percentage (q) below the below b_1 [$q < b_1$]. A medium PFAS subtype concentration range is defined as the q at or above b_1 and below b_2 [$b_1 \leq q < b_2$]. A high PFAS subtype concentration range is defined as the q at or above b_2 [$b_2 \leq q$]. The results along with the number of observations in each concentration range for each level of depression (i.e., D1, D2, D3, D4, D5) and the values of the odds ratios and corresponding confidence intervals. D1 corresponds to no depression, D2 corresponds to mild depression, D3 corresponds to moderate depression, D4 corresponds to moderately severe depression, and D5 corresponds to severe depression. All statistical analyses are conducted with R software.

Results: A total of 1,405 individuals in the study, and their respective data were analyzed via multiple linear regression and multiple logit regression approaches. The observed correlation was significant for a subset of PFAS subtypes. The findings suggest a medium quantile percentage (q) branch perfluorooctanoic acid isomers (BFOA) (odds ratio (OR) 2.010 [95% confidence interval (CI): 1.013, 3.988]), a medium n-perfluorooctanoic acid (NFOA) q (OR 6.073 [95% CI: 1.069, 34.498]), and medium perfluorononanoic acid (PFNA) q (OR 3.992 [95% CI: 1.261, 12.632]) were positively correlated with depression occurrence in adults aged 20 years and older who were not incarcerated. Alternatively, patients with a medium MFOS q (OR 0.610 [95% CI: 0.374, 0.995]), a medium MPAH q (OR 0.526 [95% CI: 0.360, 0.767]), a medium NFOS q (OR 0.681 [95% CI: 0.467, 0.993]), a medium and high PFDE q (OR 0.314 [95% CI: 0.100, 0.986]; OR 0.102 [95% CI: 0.012, 0.904]), a medium PFHS q (OR 0.272 [95% CI: 0.096, 0.772]), a high PFUA q (OR 0.170 [95% CI: 0.033, 0.881]) were inversely correlated with depression occurrence in adults aged 20 years and older who were not incarcerated. Based on single demographic covariate analysis, it was observed that females had higher levels of mild, moderate, moderately severe, and severe depression at rates of 20.6%, 6.8% 2.1%, and 0.9% compared to males with depression. Individuals with a body mass index (BMI) characterized as obese reported higher rates of mild (20.5%), moderate (5.5%), moderately severe (2.3%) depression, and severe depression (1.3%). Current smokers had higher rates of mild (22.5%), moderate (9.3%), moderately severe (4.5%), and severe (1.7%) depression as well as lower rates of no depression (62.0%), compared to individuals who have never smoked or are former smokers.

Conclusion: PFAS subtypes BFOA, NFOA, and PFNA exposure were positively correlated with depression outcomes in adults aged 20 years and older who were not incarcerated. The findings suggest exposure to BFOA, NFOA, and PFNA at a medium quantile percentage ($b_1 \leq q < b_2$) significantly increased the risk of adult depression occurrence. Given current research gaps, future studies should aim to better understand negative health outcomes associated with the correlation and causation of PFAS exposure, specifically regarding concentration, frequency, and length of exposure. Additionally, it is highly demonstrated that PFAS are persistent forever chemicals, and human exposure will only continue to increase without proper intervention. It is imperative that researchers and health professionals aspire to increase education, laboratory testing, and elimination of PFAS exposure for all individuals. In accordance with the newest EPA guidelines, additional efforts should prioritize establishing funding streams that enhance institutional infrastructure and promote the development of successful long-term detection and

maintenance efforts at a tribal, municipal, state, and federal level. Additional research is required to establish or refute these findings.

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