July 16, 2021

Medical Student Research Day 2021

I am the future
Serving others is my dream
I am Burrell COM

(by Jaron Madsen)

The cover, handdrawn by Gina Gilderman, features a female scientist wearing a breast cancer awareness pin. This pink pin serves as a stark reminder for the need for advancements in cancer research, particularly for those diagnosed with breast cancer. To be a woman in STEM requires courage, bravery, knowledge and determination - traits that are wholly exemplified by the women of Burrell College. This drawing aims to encourage women in STEM to pursue their goals and shatter expectations in all they do, as their successes and accomplishments will continue to inspire the next generation of female scientists, doctors, engineers, etc.

Contents

President's Welcome Address

It is my privilege to welcome you to the Burrell College of Osteopathic Medicine's 2021 Medical Student Research Day (MSRD)!

Thank you to our participants and our visitors for showing up to one of the College's first in-person events post pandemic. This is the third 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 first- and second-year medical students in our four major research areas of biomedical science, clinical science & osteopathic manipulative treatment (OMT), population/public health, and medical education. These key research areas have significance because of their potential for real-world application. 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 advisors, none of this would be possible. The Burrell College research community is a rising force, already making significant contributions to the improvement of public health, from their research on cancer biology to their recent work investigating the dynamics of the COVID-19 virus.

It is my hope that you will engage with our student researchers and their advisors 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
E-mail: jhummer@burrell.edu

Dean's Welcome Address

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

I am happy to see such interest in becoming the next generation of physician-scientists who will help 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
E-mail: bpieratt@burrell.edu

Assistant Dean for Research Welcome Address

It gives me great pleasure to welcome our student researchers, their faculty mentors, and our College community to the 2021 Medical Student Research Day. This year is particularly exciting as the Summer Research Experience marked the resumption of in-person research activities in the College. Equally if not more exciting is our ability to end the summer research activities by gathering into a single room for scholarly exchange.

Over the past 18 months we have isolated, teleconferenced, been reminded of human vulnerability to infectious diseases, and witnessed the importance of research in combating a pandemic. We watched intently as countless small research advancements converged and resulted in the rapid development and deployment of highly effective vaccines as well as promising therapeutic interventions. We should remember that these high profile success stories would not have been possible without the foundational research that preceded the emergence of SARS-CoV-2. The individual research efforts of small laboratories across the globe in ending a pandemic may never be fully understood, but they should be universally acknowledged.

Today, as our students report new and novel advancements in medical science, we cannot predict the ultimate impact that their research findings will have on the world. Yet, we can applaud their accomplishments, admire their intellectual curiosity, and encourage them to continue scholarly work.

Join me in congratulating our student researchers and thanking their faculty mentors as we celebrate research in the College.

Joseph N. Benoit, Ph.D.
Assistant Dean for Research
Professor of Physiology & Pathology
E-mail: research@burrell.edu

Director of Student Research Welcome Address

After a challenging COVID-19 pandemic year, it is with great pleasure that I welcome you to the much anticipated 2021 Medical Student Research Day occurring in person! Our office is committed to celebrating student research and creative scholarship achievements and looks forward to today's student presentations as we have in the previous years. I thank our visitors and participants for helping make Medical Student Research Day an exciting and memorable event as we enthusiastically honor our medical students and their mentors.

I am pleased to announce a total of 19 abstracts were submitted for Medical Student Research Day. This year students are presenting their research via 10-minute oral presentations. I am also pleased to announce that the 2021 Summer Research Experience (SRE), a 6-week research opportunity where students engage in faculty-mentored research, consists of a total of 42 students and 17 Burrell College faculty and staff, which culminates today with 16 student presentations. A review panel will judge SRE presentations, and exceptional presentations will be honored during the Awards Ceremony on August 5th.

You will find a presentation schedule in this event program where abstracts are organized into two concurrent sessions. Also included are the full abstracts, a schedule of events, judging information, and a biographical sketch of our keynote speaker.

We are honored to welcome Andrea Amalfitano, D.O., Ph.D., Dean of Michigan State University College of Osteopathic Medicine as today's keynote speaker. His research focus is developing enzyme and gene transfer-based technologies for the treatment of genetic and acquired human conditions. We eagerly await to hear about his cutting-edge research and would like to thank Dr. Amalfitano for agreeing to speak today.

Again, thank you for joining us today to make our Medical Student Research Day possible and a memorable one. I hope you enjoy this year's event and hope to see you next year.

Wishing you every success,

Steven J. Ontiveros, M.B.A., Ph.D.
Associate Professor of Anatomy & Cell Biology
Director of Student Research
E-mail: sjontiveros@burrell.edu

Keynote Speaker

Andrea Amalfitano, D.O., Ph.D.

Dean, Michigan State University College of Osteopathic Medicine

Biographical Sketch

Andrea "Andy" Amalfitano was named the Michigan State University College of Osteopathic Medicine's fifth Dean in December 2018. He is a clinical geneticist with training in pediatrics and internal medicine, as well an internationally regarded researcher in developing cutting-edge therapeutics, including enzyme and gene transfer based technologies to foster treatment of genetic and acquired human conditions such as cancer and infectious disease. Current vaccine technologies developed in the Amalfitano laboratories are currently being utilized in dozens of human clinical trials to treat a variety of solid tumors, as well as part of the *project warp speed* initiative to develop a COVID-19 vaccine.

In his clinical work he has cared for infants, children and adults potentially affected by a variety of genetic conditions, including autoimmune diseases, and this work has guided additional research output from the Amalfitano laboratories. He holds the Osteopathic Heritage Foundation endowed university chair, is a professor of pediatrics, microbiology and molecular genetics and was the director of MSU's Clinical and Translational Sciences Institute. An MSU and MSUCOM alumnus, Amalfitano is a prolific investigator, he has been a primary or contributing author on over 100 peer-reviewed journal publications, contributed to eight book chapters, nearly 100 scientific abstracts and has served on the editorial board of more than a dozen journals in addition to roles as scientific advisor or grant reviewer, the latter inclusive of NIH study sections. He has been awarded millions of dollars in extramural funding from the US government (primarily NIH), national foundations (MDA, AMDA), and corporate sponsors.

Andrea Amalfitano, D.O., Ph.D.
Dean, College of Osteopathic Medicine
Michigan State University
East Lansing, MI 48824
E-mail: amalfit1@msu.edu

Program

Opening Ceremony

8:00-8:05 President's Welcome Address

8:05-8:10 Dean's Welcome Address

8:10-8:15 Assistant Dean of Research Welcome Address

8:15-8:20 Director of Student Research Welcome Address

Concurrent Session 1: **Lecture Hall 1 (Room 160)**

Moderator: Pedro Del Corral, MD, PhD, Associate Professor of Physiology and Pathology

8:30-8:45 Transcutaneous Auricular Vagus Nerve Stimulation Induces Pancreatic Insulin Release

Kozorosky EM, Lee CHN, Lee JG, Nunez Martinez V, Padayachee LE, and Stauss HM

Department of Biomedical Sciences, Burrell College of Osteopathic Medicine

8:45-9:00 Comparing COVID-19 Survivors' Neutrophil Extracellular Traps and Associated Disease Severity

Moran O, Rutz-Robbins J, and Woods ME

Department of Physiology & Pathology, Burrell College of Osteopathic Medicine

9:00-9:15 Effects of Hypoxia on Blood Pressure and Skeletal Muscle Oxygenation During Incremental Exercise

Jahangiri OS, Singleton HS, Vaudrey K, and Del Corral P

Department of Physiology & Pathology, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

9:15-9:30 The Dose-Dependent Effects of Cannabidiol on Neutrophil Extracellular Trap (NET) Formation

Hancock TJ, Rezk CA, and Woods ME

Department of Physiology and Pathology, Burrell College of Osteopathic Medicine

9:30-9:45 Transcription Factors in MDA-MB-231BR (Brain-Seeking) Breast Cancer Cell Line of Keratin 18 gene

Johnson AE, Singh S, and Szalai G

Department of Biomedical Sciences, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

9:45-10:15 Coffee Break with Group Photo

Concurrent Session 1 Continued: **Lecture Hall 1 (Room 160)**

Moderator: Pedro Del Corral, MD, PhD, Associate Professor of Physiology and Pathology

10:15-10:30 Oleocanthal and Olive Oil May Have an Anti-Inflammatory Effect via Decreased Netosis

Guardado CA, Barr EC and Woods ME

Department of Physiology & Pathology, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

10:30-10:45 Optimizing Reverse-Transcription Loop-Mediated Isothermal Amplification (RT-LAMP) Assay for Improved Detection and Differentiation of West Nile and Zika Virus in Bodily Fluids

Kim J, Memmott MC, Subonj A,and Bramblett D

Department of Biomedical Sciences, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

10:45-11:00 Analyzing the Effects of Moderate Hyperoxia on Cardiovascular Parameters During Incremental Exercise

Campos AR, Singh K, Smith AM, Vaudrey K, and Del Corral P

Department of Physiology & Pathology, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

11:00-11:15 Qualitative Analysis of Cadaver Fluid Via GC-MS

Frezza AM, Smith HM, and Jackson JA

Department of Anatomy and Cell Biology, Burrell College of Osteopathic Medicine

11:15-11:30 Fluorescence Detection of Flaviviruses Using SHERLOCK CRISPR/Cas13a

Subonj A, Kim J, Memmott C, and Bramblett D

Department of Biomediacal Sciences, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

11:30-11:45 Coffee Break

Concurrent Session 2: **Lecture Hall 2 (Room 158)**

Moderator: Michael E. Woods, PhD, Associate Professor of Physiology and Pathology

8:30-8:45 Barriers to Pursuing Careers in Medicine Encountered by Students From Racial and Ethnic Minorities: A Case Study at Burrell College of Osteopathic Medicine

Lattin CZ, Newsome DA, Rizvi KA, Yanez MD, Yos KB, and Minugh-Purvis N

Department of Anatomy & Cell Biology, Burrell College of Osteopathic Medicine

8:45-9:00 Building 3D Interactive E-Learning Content Using Anatomical Photogrammetry

Haughton DR, McClellan JT, Ford BM, and Jackson JA

Department of Anatomy and Cell Biology, Burrell College of Osteopathic Medicine

9:00-9:15 The Baroreceptor-Heart Rate Reflex Response Does Not Correlate With the Blood Pressure Regulatory Function of the Baroreceptor Reflex

Derderian RS, Komatreddy UM, Lampert RA, Nguyen AA, Tager F, and Stauss HM

Department of Biomedical Sciences, Burrell College of Osteopathic Medicine

9:15-9:30 Socioeconomic Status as a Barrier to Medical School Application, Interviews and Admissions

Pyatetsky IA, Tavarez MS, Aluri BC, Perdomo JE, Lewis C[1], and Jackson J[2]

[1]Office of Student Enrollment Services, [2]Department of Anatomy and Cell Biology, Burrell College of Osteopathic Medicine

9:30-9:45 Quantification of Palpatory Forces Exerted During Abdominal Examination of Generally Healthy Subjects by Practicing Physicians

Stevenson KM, Wong TT, Yeelot C, and Kania A

Department of Clinical Medicine, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

9:45-10:15 Coffee Break with Group Photo

Concurrent Session 2 Continued: **Lecture Hall 2 (Room 158)**

Moderator: Michael E. Woods, PhD, Associate Professor of Physiology and Pathology

10:15-10:30 The Osteopathic Splenic Pump Technique Modulates Immune Function Potentially Through Translocation of Immune Cells From the Spleen to the Systemic Circulation

Darby KA, Dusek KL, Li TZ, Romeo ER, Kania A, Szalai G, and Stauss HM

Department of Biomedical Sciences, Burrell College of Osteopathic Medicine

10:30-10:45 Real-Time Monitoring of Sternocleidomastoid While Performing Muscle Energy Technique in Generally Healthy Subjects

Thoman FN, Chang V, and Jackson JA

Department of Clinical Medicine and Department of Anatomy & Cell Biology, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

10:45-11:00 Comparing the Surgical Outcomes of Carpal Tunnel Release in Diabetic and Non-Diabetic Populations and Exploring the Role of Diabetic Neuropathy

Jamil A, Shaghaghi N, Quinones J, Vogirala S, and Monsivais J

11:00-11:15 Development of Stevens-Johnson Syndrome in a Patient of Color

Diep D, Aluri B, and Goldsteen R

Department of Clinical Medicine, Burrell College of Osteopathic Medicine

11:15-11:45 Coffee Break

Keynote Lecture

11:45-12:45 Andrea Amalfitano, D.O., Ph.D.

Dean, Michigan State University College of Osteopathic Medicine

Genetic Experiences in Translational Research

12:45-13:45 Lunch

13:45-14:00 Final Remarks

Abstracts

Concurrent Session 1

Transcutaneous Auricular Vagus Nerve Stimulation Induces Pancreatic Insulin Release

Kozorosky EM, Lee CHN, Lee JG, Nunez Martinez V, Padayachee LE, and Stauss HM
Department of Biomedical Sciences, Burrell College of Osteopathic Medicine,
Las Cruces, NM 88001

Introduction: Despite the recent development of new classes of anti-diabetic drugs such as GLP-1 analogues, diabetic patients still have a 40-fold higher rate of limb amputations than non-diabetic patients. Our *long-term goal* is to prevent diabetes-associated long-term complications by developing a non-dietary and non-pharmacologic intervention that may complement the established therapy of type 2 diabetes. Animal experiments demonstrated that non-invasive transcutaneous auricular vagus nerve stimulation (taVNS) prevents development of diabetes in Zucker diabetic fatty rats. However, no data are available to confirm these effects of taVNS in humans. Thus, the *objective of this study* was to investigate the effects of taVNS on carbohydrate metabolism in generally healthy humans. Based on the data obtained in the Zucker diabetic fatty rats, the *hypothesis* of this study was that taVNS lowers post-prandial blood glucose levels through stimulation of pancreatic insulin secretion in humans.

Methods: The study was approved by the Burrell College Institutional Review Board. Following informed consent, exclusion criteria (diabetes, pregnancy, medication affecting glucose metabolism or the autonomic nervous system) were assessed. Weight, height, blood pressure (upper arm cuff), and time of last meal were recorded. Then subjects were instrumented with EKG electrodes and a finger cuff for continuous non-invasive blood pressure monitoring to assess the impact of taVNS on autonomic tone. Following a 30-min baseline recording, a capillary blood sample (finger prick) was obtained to determine blood glucose concentration (ReliOn Prime Blood Glucose Monitoring System, Walmart, Bentonville, AR) and hormone levels. On two different days (at least 1 week apart) taVNS (10 Hz and 300 µS) or sham taVNS (random order) was performed for 30 min followed by a 30 min recovery period, after which another blood sample was taken. Insulin, C peptide, and glucagon were measured using a Bio-Plex assay (171A7001M, Life Science, Hercules, CA). Statistical analysis was conducted using the freely available WinStat software (http://www.haraldstauss.com/HaraldStaussScientific/hemolab). Paired t-tests were used for comparisons between data obtained before and after the intervention for both study days. The Man-Whitney U-test was used for comparisons between taVNS and sham-taVNS. Statistical significance was assumed at $P<0.05$.

Results: All subjects (n=16, 13 female, 3 male) were normotensive. Body mass index (BMI) ranged from 17 kg/m^2 to 44 kg/m^2. None of the subjects were fasted. The time since the last meal did not differ for subjects undergoing the taVNS (2.4$\pm$0.4 h, n=14) or sham-taVNS (2.7$\pm$0.3 h, n=12, n.sig.) experiments. Throughout the experimental protocol, blood glucose levels tended to decline more in response to taVNS (-8.2$\pm$2.0 mg/dL, n=14) than in response to sham taVNS (-4.9$\pm$1.8 mg/dL, n=12, P=0.12). Glucagon and insulin responses to the two interventions did not differ significantly. In contrast, C-peptide levels declined significantly in response to sham-taVNS (-0.71$\pm$0.28 ng/mL, n=8, $P<0.05$), but not in response to taVNS (-0.41$\pm$0.71 ng/mL, n=8, n.sig.).

Conclusion: In participants undergoing the sham procedure, postprandial insulin and C-peptide declined throughout the study duration. The decline in C-peptide was prevented by taVNS. This finding suggests that taVNS maintained C-peptide levels by stimulating pancreatic secretion of C-peptide together with insulin. However, the short half-life of insulin (4-6 min) compared to that of C-peptide (30-60 min) masked the effect of taVNS on insulin secretion. In the next step towards achieving our long-term goal, we plan to confirm the results of the current study in patients with type 2 diabetes.

Comparing COVID-19 Survivors' Neutrophil Extracellular Traps and Associated Disease Severity

Moran O, Rutz-Robbins J, and Woods ME
Department of Physiology & Pathology, Burrell College of Osteopathic Medicine,
Las Cruces, NM 88001

Introduction: As of July 2021, the CDC reports over 600,000 American lives have been lost due to COVID-19 and this number continues to rise. A hallmark of COVID-19 is that it presents with a wide range of illness severity, based on underlying risk factors. Although much research has been conducted on the disease process of COVID-19, the reason for the wide range of disease variability is still widely unknown. Neutrophil Extracellular Traps (NETs) are a network of decondensed chromatin and proteases extruded by neutrophils to capture and destroy pathogens, such as the SARS-CoV-2 virus through a process called NETosis. Complications such as thrombosis from NETs have been implicated in a number of autoimmune and inflammatory diseases including COVID-19. We hypothesize that an individual's COVID-19 severity is positively correlated to the amount of NETs being produced by an individual's neutrophils.
Methods: We collected whole blood from COVID-19 survivors via venipuncture. SARS-CoV-2 infection was confirmed via a Bio-Plex SARS-CoV-2 Serology Assay. Participants of the study completed a survey to assess any pre-existing conditions and underlying factors that may be related to COVID-19 severity. We isolated neutrophils using MACSxpress Whole Blood Neutrophil Isolation Kits using 24-well plates, with 1x10^6 mU/mL of isolated neutrophils per well. NETosis was induced by treatment of cells with 20 nM PMA (Phorbol 12-myristate 13-acetate) or 25 μM Calcimycin (A-23187 Calcium Ionophore) during a 4-hour incubation period. We measured insoluble elastase as a marker of NETosis. We also ran an autoantibody panel using a multiplex immunoassay for Proteinase-3, Myeloperoxidase, and $\beta 2$-glycoprotein.
Results: We confirmed previous infection with a SARS-CoV-2 IgG serology assay which tested for nucleocapsid, spike-1, spike-2, and RBD (Receptor Binding Domain) antibodies. Among the subjects that have participated thus far, we observed NETosis from PMA stimulated cells, with elastase concentrations ranging from 9.35 mU/mL to 35.55 mU/mL. Data showed an average increase in elastase concentration of 12.7 mU/mL when compared to unstimulated cells. Out of 8 total subjects, 5 have responded to the survey with the rest still pending. Of the 5 that responded, one was hospitalized and had long term complications. This subject expressed an average increase in

PMA stimulated NETosis of 21.7 mU/mL when compared to their unstimulated cells. We also did not observe any autoantibodies for Proteinase-3, Myeloperoxidase, and β2-glycoprotein.
Conclusions: Preliminary data suggests that there may be a correlation between COVID-19 disease severity and NETosis. This study is ongoing with a goal of recruiting 48 total subjects. From this increased number of subjects, we hope to obtain a wider range of COVID-19 illness severity in order to draw stronger comparisons between subjects.

Effects of Hypoxia on Blood Pressure and Skeletal Muscle Oxygenation During Incremental Exercise

Jahangiri OS, Singleton HS, Vaudrey K, and Del Corral P
Department of Physiology & Pathology, Burrell College of Osteopathic Medicine,
Las Cruces, NM 88001

Introduction: Endurance exercise may be utilized to provide hypertensive patients with a non-pharmacologic intervention as oxygen concentrators to generate hypoxic air are increasingly available for commercial use. Exercise in hypoxia has been shown to increase vasodilation in comparison to normoxia, but little is known about its systemic effects. The purpose of our study was to examine the effects of hypoxia on cardiovascular variables during exercise and whether there is a relationship to skeletal muscle tissue oxygenation.
Methods: Six subjects (age 27$\pm$4.0 years, 4 male, 2 female), non-obese, resting blood pressure 120.6$\pm$10.9 mmHg systolic blood pressure (SBP), 77.1$\pm$5.6 mmHg diastolic blood pressure (DBP), apparently healthy individuals were recruited from the Las Cruces, NM area. Each subject performed two graded exercise tests to maximal effort (up to 7 stages, 2 minutes each) on a cycle ergometer (Lode Corival, Netherlands) on separate days, one normobaric normoxia (FIO2=0.207) and one normobaric hypoxia (FIO2=0.137), using an oxygen concentrator (Pro-10, Oxidation Technologies, LLC.). The trials were single-blinded using a balanced approach. Blood pressures (SBP/DBP) and heart rate (HR) (Tango Plus M2, Suntech Medical) were measured at the end of each stage and at 2, 5, and 10 min post-exercise. Rate of perceived exertion (RPE) was measured at the end of each stage, and lactate at 3 min post-exercise. Tissue oxygenation (Moxy, Fortiori Design LLC) was measured continuously on the vastus lateralis throughout exercise and 3 min post exercise. Peak oxygen uptake was measured using a metabolic cart (TrueOne 2400, ParvoMedics).
Results: In stages 1-5 for all subjects, the average HRs were significantly higher in hypoxia compared to normoxia ($p<0.05$). During exercise, subjects reported a higher RPE in hypoxia than in normoxia ($p<0.05$). Exercise time in seconds was lower in hypoxia (571$\pm$67 s) than in normoxia (683$\pm$92 s) ($p< 0.05$). Likewise, peak lactate level was higher in hypoxia (11.2$\pm$2.3 mmol/L) than in normoxia (9.7$\pm$1.65 mmol/L) ($p<0.05$). Maximum Wattage obtained during exercise was lower in hypoxia (177.1$\pm$59.4 Watts) than in normoxia (199.28$\pm$65.85 Watts) ($p<0.05$). Peak VO2 (ml/kg/min) was lower in hypoxia (28.07$\pm$6.22) than in normoxia (34.58$\pm$6.58) ($p<.05$). In contrast, higher peak SBP was found in normoxia (180.57$\pm$22.6 mmHg) versus hypoxia

(166.9$\pm$15.5 mmHg) (p$<$0.05). The minimum absolute skeletal muscle oxygenation (SmO_2) was 16.6$\pm$5.5 for hypoxia and normoxia was 23.5±10.7 (p=0.15)
Conclusions: Breathing a moderate hypoxic air during incremental exercise shows less efficient oxygen utilization and reduced work capacity while promoting an acidotic state compared to breathing normoxic air. The absolute minimum SmO_2 percentage between conditions shows a trend supporting these findings. Whether hypoxic interventions affect blood pressure during sustained exercise and post-exercise hypotension needs to be determined, and we are currently conducting submaximal exercise tests to address this.

The Dose-Dependent Effects of Cannabidiol on Neutrophil Extracellular Trap (NET) Formation

Hancock TJ, Rezk, and Woods ME CA
Department of Physiology and Pathology, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

Introduction: The incidence of autoimmune diseases has steadily increased globally over the past decade. Past studies suggest that there is excessive formation of neutrophil extracellular traps (NETs) in individuals with autoimmune and inflammatory diseases such as systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), and psoriasis. NETs are web-like structures consisting of proteins and the neutrophil's own DNA that are released through the membrane to bind and trap pathogens through the process of NETosis. Cannabidiol (CBD) is being used by individuals with autoimmune and inflammatory diseases to manage their symptoms because of its wide range of therapeutic effects including anticonvulsive, antipsychotic, and anti-inflammatory. We set out to determine the effects of CBD on NET formation and hypothesized that CBD will exert a dose-dependent effect on NETosis in peripheral blood-derived neutrophils.
Methods: We separated neutrophils from the whole blood of human volunteers via negative selection - cells besides neutrophils were targeted by beads and separated by a magnet, leaving only neutrophils. We treated the neutrophils with cannabidiol (0.1 μM, 1 μM, or 10 μM) or IM-93 (10 μM) and then induced NETosis with phorbol 12-myristate 13-acetate (PMA)(20 nM) or calcium ionophore A23187 (CI)(25 μM). We then measured insoluble neutrophil elastase activity as a marker of NETosis.
Results: Early experiments produced inconsistent results possibly due to several confounding issues. After troubleshooting, we repeated the experiment and we observed no effect of CBD on NETosis at any concentration; however, IM-93 also did not suppress NETosis as predicted. Further studies are ongoing to investigate the effect of pre-treating cells with CBD on the rate of NETosis and to confirm IM-93 inhibition of NETosis.
Conclusion: We found that NETosis was easily inducible in several steps of our protocol - which may have inadvertently stimulated the cells. For instance, we believe that during the washes we initially may have been going too slowly and induced NETosis from the cells drying out. Additionally, the buffer used throughout the protocol may have been contaminated leading to unintentional

NETosis. Furthermore, incorrect settings on the centrifuge may have contributed to the stimulation of NETosis. More troubleshooting is needed to determine why the positive control IM-93 is not inhibiting the formation of NETs. The experiment needs to be repeated in order to determine if our hypothesis is valid.

Transcription Factors in MDA-MB-231BR (Brain-Seeking) Breast Cancer Cell Line of Keratin 18 gene

Johnson AE, Singh S, and Szalai G
Department of Biomedical Sciences, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001.

Introduction: Thousands of women in the U.S will die from breast cancer this year, and with metastasis to the brain, have a survival time of less than one year. Decreasing the prevalence of brain metastasis in these patients would reduce mortality and improve the overall prognosis. In previous studies, a novel mouse model was utilized to gain a better understanding of the metastasis of triple-negative breast cancer. This model indicated that a sub-line of the MDA-MB-231 (triple-negative breast cancer cell line) preferentially metastasizes to the brain. Additionally, previous studies have shown that keratin 18 might play a crucial role in this process. Therefore, we must understand the transcriptional control of the keratin 18 gene. As of now, we are aware that the transcription factors ETS-1 and Fli-1 are associated with cancer metastasis, but there is a lack of understanding of their presence in the MDA-MB-231Br (brain-seeking) breast cancer cell line. However, previous studies have shown that ETS-1 is present in the MDA-MB-231 (non-brain-seeking) counterpart. When comparing the triple-negative breast cancer cells MDA-MB-231 with MDA-MB-231Br, past studies discovered that these cell lines differ in their expression of the keratin 18 gene, with the brain seeking cell lines having lower levels of expression. This decrease in expression may be due to hypermethylation of cytosines in intron 1 of the keratin 18 gene in the MDA-MB-231Br cell line. In this study, we analyzed the pattern of chromatin occupation of transcription factors ETS-1 and Fli-1 in the MDA-MB-231Br cells that could be responsible for the decreased expression of the keratin 18 gene. We hypothesize that keratin 18 gene expression differs between these two cell lines due to the presence or lack of transcription factors such as Fli-1 or ETS-1.

Methods: The MDA-MB-231Br cells were cultured in the Burrell research laboratory, and Chromatin Immunoprecipitation (ChIP) was performed using The Pierce Magnetic ChIP Kit by Thermo Scientific to analyze the presence of transcription factors Fli-1 and ETS-1. The ChIP Kit included the positive control anti-RNA Polymerase II Antibody and GAPDH control primers. The first step was to crosslink with formaldehyde to stabilize the interactions between DNA and proteins. The cell membranes and chromatin were then sheared into approximately 200 base pairs (bp) using Micrococcal Nuclease (MNase) and sonication, respectively. Next, ChIP-validated antibodies were used to immunoprecipitate and selectively isolate the transcription factor's (Fli-1 and ETS-1) interaction with DNA. With the newly formed antibody-protein-DNA complexes, protein A/G magnetic

beads were used to purify and reduce background information. The DNA and protein's crosslinking was then reversed with Proteinase K, and DNA spin columns were used to further purify the DNA. PCR was then performed with primers designed on NCBI with primer-blast and with primers from a previous study to amplify the intron 1 region of keratin 18. Then, an agarose gel was used to determine the extent of DNA fragment enrichment.

Results: ChIP was optimized for the 231Br cells and the conditions for the positive controls obtained expected results. The optimal sonication to break apart the chromatin into about 200 bps was found to be 20 seconds on and 20 seconds off 3 times at 40% amplitude which is about 2 watts. The primer designed on NCBI used to amplify the transcription factors did not work as expected which resulted in us utilizing alternative primers. One primer from an alternative study: forward sequence 5'-GATCATCGAGGACCTGAGGG-3' and reverse sequence 5'-GGGGAGCAGATCCTTCTTAGC-3', showed ChIP mediated enrichment of keratin 18 intron 1.

Conclusion: Ultimately, our results for the keratin 18 gene indicate that an ETS transcription factor occupies intron 1 in the MDA-MB-231Br cells. This indicates that ChIP is an effective method to use when examining transcription factors in the MDA-MB-231Br cell line in the future. We plan to perform similar experiments with the parental cell line MDA-MB-231. A quantitative PCR reaction will then be used to measure DNA binding and determine if there is a significant difference in the level of chromatin occupation between the MDA-MB-231 and MDA-MB-231Br cell lines.

Oleocanthal and Olive Oil May Have an Anti-Inflammatory Effect via Decreased Netosis

Guardado CA, Barr EC and Woods ME
Department of Physiology & Pathology, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

Introduction: With a progressively aging populace in the United States, it has been estimated that by 2030, 72 million adults will have to endure physical impairments of an arthritic disorder, particularly disorders associated with autoimmunity such as rheumatoid arthritis. As a long-term goal, we aim to evaluate the potential salubrious effect of compounds found in olive oil against the detrimentally increased rate of neutrophil extracellular trap (NET) formation routinely encountered in autoimmune conditions. Determining the most effective dose at which oleocanthal, one of the primary phenolic compounds found in olive oil, may change aberrant NETosis is necessary to validate its therapeutic value. The objective of our study is to investigate dose-dependent effects on NETosis at different concentrations of oleocanthal, and different types of extra virgin olive oil - classified as scientific (Sigma), high-grade (The Governor) and low-grade (California Olive Ranch) - in the presence of known NETosis stimulants phorbol 12-myristate 13-acetate (PMA) and A-23187 (calcimycin). It was hypothesized that increased concentrations of oleocanthal and olive oil pre-treatment would suppress primary human neutrophil NETosis induced by PMA or calcimycin.

Methods: Human neutrophils were isolated from whole blood using two approaches: negative selection by way of magnetic beads, or Polymorphprep density gradient cell separation media. Primary neutrophils underwent 1) exposure to incremental oleocanthal concentrations or 2) 1-hr incubation pre-treatment with assorted olive oil and canola oil. NETosis was induced using 20 nM

PMA or 25 μM calcimycin for 4 hours. IM-93, a known PMA-induced NETosis suppressor, was applied to neutrophil subsets. Following a 4-hour incubation, a series of washes, application of S7 nuclease, and centrifugation were performed. To estimate NETosis, a neutrophil elastase assay was used. After a 2-hr incubation, neutrophil elastase product 4-nitroaniline concentration was read via spectrophotometry at 405 nm.
Results: The rate of NETosis among the separate groups of neutrophils exposed to variable doses of oleocanthal was not significantly different (n=4, $p>0.05$, F=0.8015). Rates among groups pre-treated with olive oil were statistically significant (n=5, $p<0.05$, F=3.9629). In three subjects, neutrophils pre-treated with certain olive oil displayed significantly less NETosis in response to PMA compared to neutrophils that did not receive pre-treatment. A fourth subject displayed increased NETosis, while a fifth displayed both increased and decreased NETosis. Globally, neutrophils isolated from different subjects reflected variations in NETosis, depending on olive oil type: Sigma and The Governor demonstrated decreased NETosis compared to CA Olive Ranch, while pre-treatment with canola oil was inconclusive.
Conclusion: In vitro studies show neutrophils exposed to increasing concentrations of oleocanthal did not have a significantly lower NETosis rate compared to those exposed to lower oleocanthal concentrations. Nevertheless, neutrophil pre-treatment with olive oil or canola oil appeared to reduce NETosis activity in some subjects, while increasing activity in others. Future research considerations include running trials on subjects concurrently, increasing breadth of olive oil types, and investigating effects against NETosis of other phenolic compounds found in olive oil such as the ester oleuropein.

Optimizing Reverse-Transcription Loop-Mediated Isothermal Amplification (RT-LAMP) Assay for Improved Detection and Differentiation of West Nile and Zika Virus in Bodily Fluids

Kim J, Memmott MC, Subonj A, and Bramblett D
Department of Biomedical Sciences, Burrell College of Osteopathic Medicine,
Las Cruces, NM 88001

Introduction: Infection with Flaviviruses is a major public health challenge worldwide and in the southern United States. West Nile Virus (WNV) and Zika Virus (ZIKV) are examples of RNA viruses transmitted by mosquitoes common to the region, and both have the potential to cause sporadic outbreaks and severe neurological disorders. However, early and rapid detection of these viral infections is difficult because arbovirus prodromal symptoms are nonspecific and flu-like. Our goal is to optimize the reverse-transcription loop-mediated isothermal amplification (RT-LAMP) assay for improved point of care virus detection. Additionally, we are developing a multiplex assay using the Quenching of Unincorporated Amplification Signal Reporters (QUASR) method with RT-LAMP to simultaneously detect and differentiate WNV and ZIKV infections. RT-LAMP is a promising method for detecting viral RNA because it can amplify targets specifically and rapidly at physiological levels without expensive equipment or RNA isolation from body fluids.
Methods: RT-LAMP utilizes a set of six primers from Integrated DNA Technologies which target a distinct amplicon. We used WarmStart Colorimetric LAMP 2x kit (New England BioLabs) or

LavaLAMP RNA Component kit (Lucigen) which both contain thermostable *Bst* 2.0 DNA polymerase with strand displacement ability. The *Bst* DNA polymerase allows amplification to occur at a constant temperature. After incubation at 65 Celsius for 30 minutes, DNA amplification was confirmed via one of the following detection methods: colorimetric detection using the WarmStart kit's pH indicator, Hydroxynaphthol Blue (HNB) dye, fluorescent dye, lateral flow assay (LFA) using the HybriDetect Universal Lateral Flow Assay kit (Milenia Biotec), and gel electrophoresis. These techniques were tested in the context of various body fluids, including blood, plasma, and urine. To target geographically relevant WNV strains, we created a consensus sequence of pertinent strains using Clustal Omega and used that sequence as the template for creating new LAMP primers with Primer Explorer. To develop a multiplex QUASR assay, we labeled WNV and ZIKV LAMP primers with different fluorescent dyes so that they emit different colors while being excited at a single wavelength. Quencher probes complementary to labeled primers were also designed so that signals from remaining primers in the reaction solution are quenched.
Results: We tested the RT-LAMP protocol using synthetic WNV RNA, plasmid p$\triangle$430 (contains WNV E gene), and ZIKV RNA purchased from ATCC. After running RT-LAMP in various body fluids, we found that target amplification occurred in minimally diluted blood or blood plasma (1:5 dilution). However, RT-LAMP amplification was difficult to detect in urine unless it was diluted 100-fold. We also found that body fluids influenced the effectiveness of different detection methods. Colorimetric pH based detection and HNB detection seemed to be inhibited by all three fluid types. Testing with LFA was successful with each. Both fluorescent signal detection and gel electrophoresis, although effective, do not seem to be compatible with the goal of a quick and inexpensive bedside assay. We are currently developing and optimizing new primer sets that target geographically relevant WNV amplicons. Likewise, the QUASR method for multiplex detection of WNV and ZIKV requires further optimization for functional virus differentiation.
Conclusion: RT-LAMP is a quick, inexpensive, and reliable assay that can detect WNV and ZIKV RNAs in blood, plasma, and urine. Although the performance of the assay improves as body fluids are further diluted, RT-LAMP is less inhibited by blood and plasma than by urine. The protocol still requires some optimization, but the QUASR RT-LAMP method seems to be a promising candidate for multiplexing viral detection.

Analyzing the Effects of Moderate Hyperoxia on Cardiovascular Parameters During Incremental Exercise

Campos AR, Singh K, Smith AM, Vaudrey K, and Del Corral P
Department of Physiology & Pathology, Burrell College of Osteopathic Medicine,
Las Cruces, NM 88001

Introduction: A limiting factor during maximal incremental exercise is the delivery of oxygen to skeletal muscle tissue. Moderate hyperoxia (HYP), a condition of increased inspired oxygen concentration ($FiO_2 > 0.3$), has been shown to enhance exercise performance due to higher skeletal muscle oxygen perfusion. As the acute effects of HYP exercise have not been well documented, further investigation is needed and becoming increasingly important as oxygen concentrators are

being more commonly used during exercise for athletic improvement and patients presenting with cardiovascular disease. During maximal exercise, systolic blood pressure (SBP) and heart rate (HR) are known to increase linearly with increased workload under normoxic (NORM) conditions while the effects of HYP conditions are less well understood. The purpose of this study was to compare the effects of NORM and HYP conditions on peak exercise workload, duration, skeletal muscle oxygenation (SmO_2), SBP, and diastolic blood pressure (DBP).
Methods: Seven healthy subjects (four males and three females) were screened prior to completing two incremental maximal cycle ergometer (Lode Corival) exercise bouts on separate occasions of NORM (FiO_2 = 0.207) and HYP (FiO_2 = 0.48-0.52). HYP conditions were achieved through the use of a Pro-10 oxygen concentrator and the use of nebulizers to reach the target O2. SmO_2 was continuously measured during exercise via Near Infrared Spectroscopy (NIRS) sensor (Moxy5 Fortiori Design LLC) on the vastus lateralis. SBP, DBP, and HR were measured at the end of each 2-minute stage via Tango Plus M2 (SunTech Biomedical). Respiratory parameters were measured in 30-second intervals via Parvomedics Trueone 2400 metabolic cart. Blood lactate levels were measured at peak exercise. All trials were single blinded using a balanced approach.
Results: Increased Exertion: Hyperoxia was achieved at an FiO_2 of 0.505 ± 0.01 and normoxia was achieved at an FiO_2 of 0.207 ± 0.0. The average maximum wattage (W) obtained on cycle ergometer was significantly higher ($p<0.05$) with a HYP of 212 ± 79 W vs NORM 199 ± 65 W. Total exercise time in seconds (sec) also showed an increasing trend (p=0.068) with a HYP of 720 ± 112 sec vs NORM 683 ± 92.5 sec. Subsequently, peak average lactate levels significantly increased (p=0.051) with a HYP of 11.67 ± 3.78 mmol/L vs NORM 9.73 ± 1.66 mmol/L.
Skeletal Muscle Oxygenation: Under HYP conditions, preliminary data collected displayed a potential increase in baseline resting SmO_2 while having a similar slope of tissue desaturation during maximal exercise when compared to NORM.
Heart Rate,Blood Pressure, RPE: There was no statistical difference between the response to NORM and HYP conditions with respect to peak SBP, DBP, and HR. Peak RPE values showed a strong increasing trend (p=0.07) under HYP conditions compared to NORM.
Conclusions: Initial data suggests that HYP allow subjects to reach higher levels of exercise performance during incremental exercise. Increased exercise workload, exercise time, blood lactate levels, and RPE values during HYP indicate an increased ergogenic performance, compared to NORM. We are currently conducting further studies with respect to submaximal trials in order to examine the effects of HYP during steady state exercise and on the post exercise hypotensive response. This could potentially better inform individuals who use HYP for exercise interventions.

Qualitative Analysis of Cadaver Fluid Via GC-MS

Frezza AM, Smith HM, Jackson JA
Department of Anatomy and Cell Biology, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

Introduction: Each year, over 22,000 students matriculate into medical school. At some point in their medical education, most of these individuals will work with whole-body donor cadavers to

further their understanding of the human body. In this work, students, anatomy faculty, and staff, are likely to face exposure to potentially toxic chemicals and compounds present in the cadavers, including residual pharmaceuticals. While many of the preservative chemicals are well-known and characterized, it is unclear whether the embalming process removes pharmaceutical agents and their metabolites. Furthermore, it is unclear if these compounds pose an additional risk to those working with the donor specimens. Due to the large number of individuals exposed to the cadavers, further understanding of the chemical composition within the specimens will allow laboratories to better protect those involved. The purpose of this project was to determine whether there are detectable levels of pharmaceuticals present in cadaver fluid.
Methods: Fluid samples were collected from the abdominal and pleural cavities of three human donor bodies during the dissection process by Burrell's Summer Dissection Program. Each sample was subjected to a liquid-liquid extraction process to separate normal body compounds from the potential pharmaceuticals present. Using the Virginia Department of Forensics Toxicology Procedures Manual (VDFTPM), potential basic and acidic/neutral drugs were extracted from each sample (using procedures 9.6.2 and 9.6.3 respectively, with a few substitutions). The extract samples were subsequently separated by gas chromatography (Agilent 7890A) following the protocol of VDFTPM 9.5.14. Helium gas was used as the mobile phase through a polysiloxane capillary column. Upon separation, samples were immediately analyzed by mass spectrometry (Agilent 5975C Single Quadrupole) and reviewed using the National Institute of Standards and Technology mass spectrometry library.
Results: We were unable to detect any compounds from the samples using gas chromatography-mass spectrometry (GC-MS). Comparison of the samples to the negative control revealed no distinguishable peaks, including internal standards/positive controls, on the chromatograms. Known substances in the cadaver fluids, including formaldehyde and glutaraldehyde, were excluded from detection by the GC-MS due to the protocol's limitations.
Conclusion: There are several possible explanations for the absence of detectable pharmaceuticals. One possibility is the concentration of the drugs/metabolites may be lower than the limit of detection (0.25 mg/ml) of the GC-MS. Another possibility is the protocol used was not adequate for the type of samples we were analyzing, and further development on the GC-MS parameters must occur. This provides a future direction the project can be taken to supplement these results. Finally, it is likely that most detectable pharmaceuticals are adequately eliminated via the embalming process. If so, individuals working with whole-body donors are not at any increased risk of toxicity due to residual pharmaceutical compounds.

Fluorescence Detection of Flaviviruses Using SHERLOCK CRISPR/Cas13a

Subonj A, Kim J, Memmott MC, and Bramblett D
Department of Biomediacal Sciences, Burrell College of Osteopathic Medicine,
Las Cruces, NM 88001

Introduction: As seen in the Zika (2015) and Coronavirus SARS-COV2 (2019) outbreaks, rapid diagnosis and response time are key to minimizing the devastating impact of a virus. Our long-term

goal is to develop cheap and fast diagnostic techniques to prevent uncontrolled viral outbreaks. The Flaviviridae are a virus family with high morbidity and mortality, responsible for neuroinvasive diseases with potentially long-term cognitive and neurologic effects such as meningitis and encephalitis. Many Flaviviruses are mosquito-transmitted, and rising global temperatures promote the survival of Flavivirus' mosquito vectors across larger areas, resulting in the rapid spread of Flaviviruses. Specific high sensitivity enzymatic reporter unlocking, or SHERLOCK, is a CRISPR-based isothermal reaction that offers quick and highly specific viral detection without the need for expensive lab equipment. However, SHERLOCK is a novel molecular technique that few labs have tested. The aim of our study is to optimize and standardize a protocol for the use of SHERLOCK in detecting synthetic Zika and West Nile RNA.

Methods: SHERLOCK reactions involve two stages: an isothermal Reverse Transcriptase Recombinase Polymerase Amplification (RT-RPA) and a Cas (CRISPR) reaction for detection and fluorescence reporting. The reporter is a short, quenched, ribo-oligonucleotide that is cleaved by activated Cas13a, causing fluorescence. To optimize SHERLOCK for each viral target, we modified an RT-RPA protocol provided by TwistDx™ and a Cas reaction protocol published by Kellner et al. After validating successful detection of synthetic Zika RNA using the primers and crRNA provided in the Kellner et al. paper we sought to increase the fluorescence output. Initially, we varied incubation temperature, incubation time, primer concentration, and magnesium acetate concentration in the RT-RPA reaction, however, these modifications did not significantly improve fluorescence. Next, optimization was performed on the Cas reaction by varying the starting quantitiy of RT-RPA product added, comparing rehydration buffer solutions used for the fluorescent reporter, and finally attemping to preincubate the guide RNA and Cas13a for varied times to promote binding. Futher work is being done to develope a novel West Nile SHERLOCK protocol with these new modifications. We are currently optimizing West Nile RT-RPA primers and crRNA.

Results: Our optimization experiments for RT-RPA showed that an incubation at 42°C for 25 minutes with a 10μ M primer concentration yielded the highest amplification, while varying the amount of magnesium acetate for activation of the RT-RPA reaction did not significantly change the amount of amplicon generated. For the Cas reaction, we found no significant difference in fluorescence from changing the type of buffer used to rehydrate the fluorescent reporter or from increasing the initial amount of RT-RPA product. However, allowing the Cas protein and crRNA to pre-incubate prior to adding them to the Cas reaction master mix did have a significant effect on fluorescence reporting. Pre-incubation times of 10, 15, and 20 minutes showed an increase in 250, 270, and 300 Relative Fluorescence Units (RFUs), respectively, when compared to a zero minute pre-incubation time. The original Nature protocol does not mention a pre-incubation step, and we feel that adding this step significantly improves the protocol.

Conclusion: In the future, we plan to investigate the specificity of SHERLOCK by gradually introducing single-nucleotide changes into the crRNA, potentially allowing us to distinguish between different strains of a virus. Additionally, we plan to multiplex SHERLOCK, which would allow us to rapidly screen for multiple potential viruses at once and output a highly specific diagnosis much quicker than most other methods.

Concurrent Session 2

Barriers to Pursuing Careers in Medicine Encountered by Students From Racial and Ethnic Minorities: A Case Study at Burrell College of Osteopathic Medicine

Lattin CZ, Newsome DA, Rizvi KA, Yanez MD, Yos KB, and Minugh-Purvis N
Department of Anatomy & Cell Biology, Burrell College of Osteopathic Medicine,
Las Cruces, NM 88001

Introduction: Diversifying the physician workforce has important implications for patient compliance and, hence, outcomes. Numerous studies have established that patients are more likely to seek medical care, and express greater satisfaction when the race and ethnicity of the physician matches their own (concordance). Changing US demographics over the past 50 years have magnified the need to recruit medical students from all ethnicities. Yet, since the establishment of the Association of American Medical Colleges (AAMC) Office of Minority Affairs in 1969, underrepresented minority (URM) recruitment has continued to lag behind that of White and Asian Americans and, for some ethnicities, has shown a decline (AAMC.org). The current rate of URM matriculation into US medical schools falls far short of the estimated 8,000 needed annually by 2060 in order to mirror the country's patient population (Emery et al., 2018). This demonstrates the necessity to better understand what disparities are responsible for insufficient minority matriculation rates into US medical schools. Burrell College of Osteopathic Medicine, located in Las Cruces, New Mexico, is one of the most diverse medical schools in the country with an average of 25.9% of class enrollment comprised of URMs since its inception (AACOM.org). Our study examines obstacles reportedly experienced during the medical school application process by the Burrell Classes of 2022, 2023, and 2024. Rather than focus on quantitative aspects of academic record and finances, our questionnaire asked respondents about such variables as the need to work and care for family members; time elapsed between undergraduate graduation and medical school matriculation; students' home community characteristics; availability of educational resources and advising; family and peer support or lack thereof; and students' own confidence in their decision to pursue a career in medicine.

Methods: Following Burrell IRB approval, a 37-question survey was developed and subsequently distributed via Qualtrics (Provo, Utah, USA) to all Burrell students matriculated as of June 29, 2021. Collected data were examined and subjected to a variety of statistical analyses using Qualtrics, Excel (Microsoft, Seattle, WA), and JMP (SAS, Carey, NC).

Results: A total of 135 survey responses were received (29.41% response rate). Self-doubt (56.3%); cost of applying (51.1%); and needing to work (43.7%) were selected as the most common obstacles to achieving medical school matriculation. Nearly half of respondents (42.7%) self-identified as members of a medically underserved ethnic or minority community. In comparing students who reported that they belonged to a medically underserved ethnic community versus those who reported that they did not, family obligations (67.6%); needing to work (54.2%); and perceived time commitment (55.6%) were more often selected as barriers to the medical school application process.

Conclusion: The medical school application process is a highly competitive one, presenting challenges and obstacles to a considerable portion of the annual applicant pool. However, our results suggest that the 'barrier profile' confronting URM students is significantly different than that experienced by ethnic majority students. Limitations of this study included a small sample size and

distribution to a student population at a single institution. Nevertheless, this preliminary identification of obstacles encountered by URM students provides new insight regarding their lower rates of enrollment and will hopefully stimulate further discussion of potential solutions leading to a rebalancing of US physician:patient ethnic concordance.

Building 3D Interactive E-Learning Content Using Anatomical Photogrammetry

Haughton DR, McClellan JT, Ford BM, and Jackson JA
Department of Anatomy and Cell Biology, Burrell College of Osteopathic Medicine,
Las Cruces NM, 88001

Introduction: When COVID-19 hit, much of the medical education community adapted rapidly to online learning. Inconstant access to anatomical specimens and teaching materials revealed many limitations in certain aspects of the new reality of online instruction. Three-dimensional interactive content was needed to better teach complicated anatomical structures to medical students, but the resources for providing these are severely limited or very expensive. Our goal was to develop an inexpensive and reproducible procedure for generating 3D models of anatomic structures and creating e-learning content from these models in the form of quizzes and labeled interactive models.

Methods: With the use of 35 mm DSLR cameras, we took a series of pictures using two methods to obtain a 360° view around the specimen. The first method was keeping the camera(s) stationary, while rotating the specimen. The specimen was rotated at 15-30° increments between each exposure until every aspect of the specimen was captured. This was repeated multiple times with the camera(s) adjusted in vertical and horizontal aspects, until an ”exposure map” of the specimen indicated that all surfaces of the specimen had been photographed. The second method was to keep the specimen stationary while moving the position of the camera(s) around the specimen, using the same incremental changes as described above. Once sufficient images were obtained, an open-source program called Meshroom (https://alicevision.org/#meshroom) compiled the images into a 3-dimensional virtual model of the specimen. The models were edited using open-source software called Blender (https://www.blender.org) and then modified using Jupyter Notebook software (https://jupyter.org/), which facilitated the addition of labels and conversion into HTML formats for quizzes.

Results: We were able to produce 15 models for anatomical instruction. Method one worked well for smaller objects that easily fit entirely within the frame of the camera such as hearts, individual lungs, and livers. Method two was used for specimens that were too large to fit entirely within the frame of the camera, such as limbs and an entire cadaver. Method two was the preferred option for all models as it more reliably produced accurate and clear models. We generated a number of interactive quizzes using the models in an HTML file format. These were evaluated using the Learning Catalytics platform, and functioned properly. However, accessing the 3D object files from within the quiz framework of Learning Catalytics required an additional URL link. This will require creation of a dedicated Burrell Anatomy website, which can host this protected content behind a

security firewall to conform with our anatomical gift program custodial agreement with the Texas Anatomical Board.
Conclusion: This project has offered a possible solution to not having direct access to gross anatomical specimens by creating interactive 3D virtual models from human tissue. In addition to creating a local resource for our students to use outside of the lab environment, these high-quality 3D interactive resources may present an opportunity to share the Burrell Anatomical Gifts Program resources outside of Burrell through licensure or collaboration agreements with other health education users.

The Baroreceptor-Heart Rate Reflex Response Does Not Correlate With the Blood Pressure Regulatory Function of the Baroreceptor Reflex

Derderian RS, Komatreddy UM, Lampert RA, Nguyen AA, Tager F, and Stauss HM
Department of Biomedical Sciences, Burrell College of Osteopathic Medicine,
Las Cruces, NM 88001

Introduction: The CDC estimates that by 2030 seven Americans will die every hour from falling. Many of these falls result from orthostatic intolerance due to baroreflex dysfunction. The *long-term goal* of this research is to prevent these deaths by establishing a reliable measure of baroreflex function to assist with the diagnosis of orthostatic intolerance. The most frequently used measure of baroreflex function is the baroreceptor-heart rate reflex response. However, the baroreceptor-heart rate reflex response ignores the effect of the baroreceptor reflex on total peripheral vascular resistance. Thus, the baroreceptor-heart rate reflex response is an incomplete measure of the actual impact of the baroreflex on blood pressure (BP) regulation. The *objective of this study* was to establish and validate a more complete measure of baroreflex function. The *hypothesis* was tested that the BP perturbation during spontaneously occurring sequences of continuous heart beats that are consistent with baroreflex responses, is a more complete measure of baroreflex function than the baroreceptor-heart rate reflex response.
Methods: The Burrell College IRB exempted the study from IRB review. BP waveforms from the MIMIC-III data set (http://www.physionet.org), consisting of 53,423 distinct critical care unit admissions at Beth Israel Deaconess Medical Center, were retrospectively analyzed. From the 53,423 admissions, 103 patients were selected based on the quality of the BP waveforms, absence of cardiac arrhythmia, and no admission diagnoses affecting baroreflex function, such as coma. These 103 patients were classified as patients with presumably impaired baroreflex function or as control patients based on age (above 65 years vs. 18-45 years) and the presence or absence of: hypertension, obesity, and diabetes. Sequences of a minimum of four consecutive heart beats where systolic BP and inter-beat interval changed in the same direction were extracted from the BP waveforms. The slope of these sequences is generally accepted as the gain of the baroreceptor-heart rate reflex. In addition, the difference between the lowest and highest systolic BP values within each sequence was defined as the BP perturbation during the respective sequence. A high gain and small BP perturbation reflects potent baroreflex function. Independent or paired Student's t-tests were used for comparisons between data obtained from the two groups of patients or

data obtained during the first five hours after admission vs. the last five hours before discharge, respectively.

Results: The gain of the baroreceptor-heart rate reflex did not differ significantly between the control patients and the patients with presumably impaired baroreflex function (admission: 7.4$\pm$0.4 ms/mmHg vs. 8.0$\pm$1.2 ms/mmHg, n.sig.; discharge: 8.7$\pm$0.5 ms/mmHg vs. 9.5$\pm$1.6 ms/mmHg, n.sig.), suggesting similar baroreflex function. In contrast, the BP perturbations during the sequences were significantly smaller in the control patients (admission: 9.5$\pm$0.6 mmHg; discharge: 9.2$\pm$0.4 mmHg) than in the patients with presumably impaired baroreflex function (admission: 12.1$\pm$1.8 mmHg, P=0.11; discharge:12.7$\pm$1.3 mmHg, P$<$0.05), suggesting better baroreflex function in the control patients. The gain of the baroreceptor-heart rate reflex improved from admission to discharge in the control patients (7.4$\pm$0.4 ms/mmHg vs. 8.7$\pm$0.5 ms/mmHg, P$<$0.05), but not in the patients with presumably impaired baroreflex function (8.0$\pm$1.2 ms/mmHg vs. 9.5$\pm$1.6 ms/mmHg, n.sig.). The BP perturbations did not improve significantly from admission to discharge in either group.

Conclusion: The gain of the baroreceptor-heart rate reflex failed to discriminate between young control patients and elderly patients with hypertension, obesity, and diabetes. On the other hand, the BP perturbations during the sequences were able to discriminate between these two patient populations. As the patients' clinical condition improved from admission to discharge, the gain of the baroreceptor-heart rate reflex improved in the control patients. This improved baroreflex function did not translate into better BP regulation because the BP perturbation did not decline from admission to discharge. The BP perturbations during the baroreflex sequences appear to better characterize the impact of impaired baroreflex function on blood pressure regulation, orthostatic intolerance, and potential risk for falls than the gain of the baroreceptor-heart rate reflex response.

Socioeconomic Status as a Barrier to Medical School Application, Interviews and Admissions

Pyatetsky IA, Tavarez MS, Aluri BC, Perdomo JE, Lewis C[1], and Jackson JA[2]
[1]Office of Student Enrollment Services, [2]Department of Anatomy and Cell Biology, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

Introduction: According to the Liaison Committee on Medical Education, who set the standards required for accreditation of United States medical schools, admissions committees must strive to achieve greater student body diversity to promote the development of a more culturally sensitive physician workforce that is better prepared to meet the various health needs of our population. Yet, many qualified students from economically disadvantaged backgrounds continue to face additional challenges throughout the application process, as compared to financially stable applicants. Despite implementation of affirmative action policies and holistic-based evaluation of applicants, the candidate pool remains skewed toward those with the means to afford the high costs associated with Medical College Admissions Test (MCAT) preparatory programs, numerous application

fees and travel for interviews. These expenses may limit disadvantaged applicants from fully participating in the admissions process, which perpetuates the trend of a physician workforce that does not accurately represent our diverse population. This study aims to gain perspective about the extent to which socioeconomic factors hindered current medical students throughout the application process.

Methods: Through analysis of multiple sources including AAMC/AACOM, United States Census data and prior publications, we developed a web-based survey with the purpose of identifying the degree to which socioeconomic status (SES) impacts medical school applicant outcomes. We aim to conduct a cross-sectional survey of current medical students. Each respondent will self-report demographic data including race/ethnicity, gender identity, hometown zip-code (as an index of SES) and parental level of education. Each respondent who completes the survey will be given the opportunity to enter a raffle for a Starbucks gift card.

Results: Currently, our survey is pending Burrell COM Institutional Review Board approval. Based on our review of prior studies that examined medical school applicants from a spectrum of socioeconomic backgrounds, we predict that students from lower income households (as indicated by hometown zip-code) will report having encountered more barriers throughout the application process than their counterparts from zip-codes associated with higher income households. Even with access to fee assistance programs, disadvantaged applicants are still responsible for costs not covered by these programs such as commercial MCAT preparatory courses and interview-related travel expenses. As a result, these students may be limited in their ability to submit a competitive application to medical schools.

Conclusion: The substantial costs associated with applying and interviewing for medical school programs may be a source of impediment to the diversification of applicant pools. By collecting data with this survey, we hope to gain clarity on significant factors serving as barriers to the enrollment of disadvantaged applicants. We will use this data to call for further efforts and policy changes to recruit a more demographically representative physician workforce.

Quantification of Palpatory Forces Exerted During Abdominal Examination of Generally Healthy Subjects by Practicing Physicians

Stevenson KM, Wong TT, Yeelot C, and Kania A
Department of Clinical Medicine, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

Introduction: Palpation is a complex skill for beginning medical personnel to learn. Standardization of palpation is difficult as pressures exerted during an abdominal exam are unknown without the use of pressure sensors. Therefore, knowing typical pressures that are applied while performing an abdominal exam will create a normative database and could be valuable for the instruction of this skill.

Methods: Thirty physicians were recruited to palpate the abdomen of subjects with varying body mass indices (BMI): normal, overweight, and obese. Subjects were selected to be free of any abdominal disorders or previous surgery. The pressures exerted during the abdominal exam were quantified with Novel LoadPad sensors attached to the palpating hand while examining the four

abdominal quadrants, liver, spleen, and kidney. Pressure readings were plotted against varying gender, length of time in practice, physician specialties, US-trained vs non-US-trained physician examiners, and subject BMI.
Results: The range of pressures used to palpate lightly was 8.8±3.4 N, liver 17.0±8.2 N, spleen 16.5±7.3 N, and kidney 17.6±7.7 N. There was no difference between men and women when palpating lightly in the four quadrants or kidneys. However, women used lighter pressure when evaluating the liver and spleen, trending toward significance. When evaluating pressures generated during palpation, the years in practice showed no difference for light four-quadrant, spleen, or kidney evaluation, but a significant difference (p= 0.028) when palpating the liver. Generally, the longer a physician is in practice, the less pressure is used. When evaluating the data based on clinical specialty, those specialized in Osteopathic Neuromuscular Manipulative Medicine (ONMM) tended to use lighter pressures. There was a statistically significant difference in pressure used for palpation based on whether a physician did their training in the US or abroad when assessing the spleen (p=0.03). Non-US-trained physicians used lighter pressures than US-trained physicians. There was no distinction for light palpation in four quadrants or spleen in subjects regardless of their BMI, but did show a trend for less force applied for the liver and kidney evaluation for those subjects with normal BMI.
Conclusion: There is a wide range of pressures used when performing an abdominal exam. The results acquired during this study confounds recommendations for teaching methods for those in the healthcare profession. Women, ONMM specialists, and non-US based-trained physicians tended to use lighter pressures, regardless of subject BMI. The limitations of this study include the narrow variation of BMI of the subjects, the limited number of subjects evaluated per physician participant, and few participants in various specialties, such as those who are pediatricians or surgeons.

The Osteopathic Splenic Pump Technique Modulates Immune Function Potentially Through Translocation of Immune Cells From the Spleen to the Systemic Circulation

Darby KA, Dusek KL, Li TZ, Romeo ER, Kania A, Szalai G, and Stauss HM
Department of Biomedical Sciences, Burrell College of Osteopathic Medicine,
Las Cruces, NM 88001

Introduction: While novel biologic drugs have ameliorated the disease-burden of patients with chronic inflammatory diseases, the high costs associated with these drugs are prohibitive for a large number of patients. The *long-term goal* of this research is to develop more accessible treatment modalities for patients with chronic inflammatory diseases. Osteopathic lymphatic pump techniques have been used successfully to modulate immune function, but the exact mechanisms for this effect are elusive. The *objective of this study* is to identify the mechanisms by which the splenic pump technique, an osteopathic lymphatic technique, modulates immune function. Understanding these mechanisms is essential for the development of more accessible treatment modalities for patients with chronic inflammatory diseases based on lymphatic pump techniques. The *hypothesis* was tested that the splenic pump technique affects translocation of immune cells

from the spleen to the systemic circulation where these cells modulate immune function by synthesis and release of cytokines.
Methods: Generally healthy adults received either splenic pump (n=7) or a sham intervention (n=11) for 10 min on three consecutive days. After the intervention on the third study day, a venous blood sample was collected to determine the relative abundance of different cell populations (flow cytometry, Guava EasyCyte Mini, Millipore Sigma, Burlington, MA) and plasma cytokine concentrations (BioPlex #M50000007A, Life Science, Hercules, CA). In addition, monocytes were isolated (magnetic bead separation technique, Pan Monocyte Isolation Kit, Quadro-MACS Separator, Miltenyi Biotec, San Diego, CA) and their interleukin-6 (IL-6) mRNA expression determined by RT-PCR. Data obtained following the splenic pump intervention were compared to data obtained following the sham intervention by independent Student t-tests.
Results: A larger number of circulating monocytes and a smaller number of natural killer (NK) cells were found following three days of splenic pump application (monocytes: 2.2 ± 0.3 %; NK-cells: 0.31 ± 0.15 %, n=7) compared to after three days of sham intervention (monocytes: 1.3 ± 0.2 %, $P<0.05$; NK-cells: 1.40 ± 0.24 %, n=8, P=0.06). The other cell populations (CD4+ and CD8+ T-cells, Th17 cells, regulatory T-cells, B-cells, and dendritic cells) did not differ significantly between the two groups. Plasma interleukin-8 (IL-8) concentrations were lower following the splenic pump intervention (1.14 ± 0.51 pg/mL, n=6) compared to following the sham intervention (2.63 ± 0.53 pg/mL, n=11, P=0.09). IL-6 mRNA expression was detected in isolated monocytes from subjects of both groups (n=1 for sham intervention, n=3 for splenic pump).
Conclusion: The lower IL-8 plasma levels following the splenic pump intervention compared to the sham intervention may be related to a decrease in the number of circulating NK-cells, because NK-cells are known to produce IL-8. Furthermore, the greater number of circulating monocytes following the splenic pump may modulate the immune system through synthesis and release of IL-6. These findings provide novel insights into the mechanisms by which the splenic pump technique may modulate immune function.

Real-Time Monitoring of Sternocleidomastoid While Performing Muscle Energy Technique in Generally Healthy Subjects

Thoman FN, Chang V, and Jackson JA
Department of Clinical Medicine and Department of Anatomy & Cell Biology, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

Introduction: Despite the anecdotal successes reported by patients of Doctors of Osteopathic Medicine who performed osteopathic manipulative medicine (OMM), there has been no direct quantitive measurement confirming the mechanics for presumed physiologic changes that occur during OMM. Muscle energy techniques are frequently utilized in those with somatic dysfuntions (SD) of muscles, a state away from normal function. Many theories have been proposed as to what causes SD's, two of which help explain how muscular SD's can come about. First, the nociceptive theory revolves around the body's response and adaptation to pain signals that in the long term create an increased gamma-gain (increased firing rate of gamma motor neurons) to shorten

muscles in attempts to prevent pain. Second, the proprioceptive theory focuses on gamma-loop malfunction, meaning the miscommunication between muscle, muscle spindle, and central nervous system (CNS) causing SD. Assuming these theories are correct, the outcome of using post-isometric relaxation (PIR) technique and reciprocal inhibition technique works by resetting the gamma-gain/loop. Doing this brings the gamma motor neuron to the intrafusal fibers of the muscle to a normal basal firing rate and/or correcting the imbalance of the alpha motor neuron firing rate and gamma motor neuron firing rate. This allows the intrafusal fibers to match the length of the muscle itself, which is the normal physiologic state. We plan to record if and when the resetting of the gamma-gain/loop occurs as decreased tone during PIR and reciprocal inhibition intervention of the sternocleidomastoid (SCM) as indicated by electromyography (EMG).

Methods: We will evaluate each subject's SCM via EMG electrodes placed along the total length at 40% and 60%. Subjects will be evaluated for SDs from C7 to atlanto-occipital joint prior to the intervention. All subjects will then be randomized to which SCM was to receive PIR intervention first. Each subject's intervention starts with flexion of the neck at 25°, 0° side-bending, 0° rotation as neutral. Baseline recordings of each SCM occur at neutral for 30 seconds after resting for 5 minutes. The intervention will be performed while taking an EMG recording starting with side-bending away from the SCM to 20° (subjets bregma will be used as central point) and having subject straighten up against 4 ± 1 newtons (N) of force for a total of 5 seconds. After which, the subject will relax and the cycle is repeated 3 more times with increases of 4° each time. At neutral, another baseline recording will occur before performing the same intervention, except with rotation, toward the SCM. Once both SCM's have undergone the interventions, a final EMG will be taken at the neutral point.

Results: We expect to see the initial baseline tone (hypertonicity) of each subjects' SCM decrease throughout the interventions. The muscles hypertonicity should be the lowest at the end of the intervention signifying the reset of gamma-gain. Based on other research studies, we expect to see background noise from superficial muscles such as platysma. This is because superficial EMG electrodes pick up activity of other muscles that lie near the electrodes being placed. The background noise should not be able to overshadow the activity of SCM because the intervention being used targets the primary actions of SCM and not platysma.

Conclusions: There are currently no known studies measuring the response of muscles during osteopathic manipulative treatment (OMT); however, there are studies that report muscle response during strengthening exercises via EMG. It has been reported that those with chronic neck pain have increased hypertonicity of superficial flexors including SCM. One study specifically focused on stabilization of the neck and measuring the response from SCM in those who have chronic neck pain. This study found during stabilization exercises the SCM activity significantly decreased. We expect to see reduced SCM hypertonicity using PIR and reciprocal inhibition, based on the gamma-gain theory with proprioception and nociception theory.

♣

Comparing the Surgical Outcomes of Carpal Tunnel Release in Diabetic and Non-Diabetic Populations and Exploring the Role of Diabetic Neuropathy

Jamil A, Shaghaghi N, Quinones J, Vogirala S, and Monsivais J

Objective: To assess the difference in recovery rate of diabetics and non-diabetics after carpal tunnel surgery using multidimensional pain assessments.

Methods: This study was conducted using a retrospective study design. Diabetic and non-diabetic patients that underwent carpal tunnel surgery from 2015-2020 were selected from a hand surgeon's patient database. 45 diabetic patients and 106 non-diabetic patients were randomly selected. Patient outcomes were evaluated using preoperative and postoperative pain scale assessments including: Disabilities of Arm Shoulder and Hand (DASH), Brief pain Index (BPI), Wong Baker, Numeric Pain Scales, and Boston Scientific Pain Scale. Postoperative evaluations were taken 6 months to a year post surgery. Additionally, biopsy-proven small fiber neuropathy was used as a confounding variable in the assessment of diabetic patients recovery rates.

Results: The results of the study show that non-diabetic patients had a greater healing rate than diabetic patients when comparing all five assessments. The numerical pain scale for non-diabetics improved by 64%. Wong-Baker scores improved by 58%, DASH score improved by 19.2%, BPI improved 42%, and the Boston Pain scale improved by 47%. In comparison, the diabetic population numerical pain scale had a 51% improvement, Wong-Baker assessment improved by 28%, DASH improved by 12%, BPI improved by 27%, and the Boston Pain scale improved 7%. Of the 22 biopsies taken from diabetic patients, 12 were positive for small fiber neuropathy and 10 were negative. When comparing diabetics with biopsy-proven neuropathy to diabetics without neuropathy, the healing outcomes are increasingly better for diabetics without neuropathy. The difference in numerical and BPI assessments using initial and subsequent measures, for both biopsy proven neuropathy and without neuropathy, are about the same: 3.00 and 3.02 for numerical, and 16.6 and 17.2 for BPI. The greatest improvement in non-diabetics without neuropathy was seen in Baker, DASH, and Boston scales with differences between initial and subsequent assessments at 0.188, 5.17, and 0.486 respectively. Diabetics with biopsy proven neuropathy have improvement in healing outcomes as well; however, not as much as the non-diabetics. The Baker, DASH, and Boston scale difference between initial and subsequent assessments were the following: 1.93, 16.89, and 0.725.

Conclusion: In conclusion, the recovery rate of non-diabetics is significantly greater than diabetics after undergoing carpal tunnel surgery. Additionally, the diagnosis of biopsy-proven small fiber neuropathy limits the recovery rate of diabetic patients.

Development of Stevens-Johnson Syndrome in a Patient of Color

Diep D, Aluri BC, and Goldsteen R
Department of Clinical Medicine, Burrell College of Osteopathic Medicine, Las Cruces, NM 88001

Introduction: Stevens-Johnson Syndrome is a life-threatening disorder of cutaneous and mucosal membranes that results as a side effect from numerous medications. Our patient is a 26-year-old African American woman who had recently undergone a dental procedure presented with facial swelling and some upper airway breathing difficulties. She was treated with antihistamines and steroids for what was presumed to be an allergic reaction of unknown etiology, and later the delayed diagnosis of Stevens-Johnson Syndrome was revealed by cutaneous biopsy from her use of carbamazepine.

Results: From the initial presentation, the patient's condition progressed over two days with swelling, mucus on the eyes, and red spots on the palms. Before the diagnosis was established, the patient was treated with phenoxymethylpenicillin and paracetamol for some tonsillar fullness, and conjunctival injection. This was misdiagnosed and the patient's condition continued to worsen and culminated in hospital admission, where she collapsed and was resuscitated. Eventually, the formal diagnosis of carbamazepine-induced Stevens-Johnson Syndrome by biopsy was given.

Conclusion: When initial treatments for the presumptive diagnosis based on clinical history fails to prevent the rapid worsening of the morphology of a patient's condition, considerations for hospitalization and biopsy should be urgently advised. Medical education should be more inclusive of skin disorders in patients of color in order to train healthcare professionals to quickly and accurately recognize cutaneous disorders that may be life-threatening.

Awards

Judging Criteria

The purpose of the presentation is to clearly communicate and convey the significance and major points of the research project to a wide variety of audience members. Oral presentations will be scored out of 30 possible points, and will be judged according to the following criteria:

- Quality of abstract
- Content of presentation
- Depth of knowledge of student presenters
- Organization of content
- Delivery and clarity of presentation
- Ability to respond to questions

Judging Rubric

Standards	Exemplary (5-4)	Satisfactory (3-2)	Unacceptable (1-0)
Abstract	Abstract is well written, strongly represented the student's research. Clearly supported topic presented and contained important points.	Abstract is marginally written, somewhat able to see connection of abstract to re-searchpresentation. Abstract did not contain sufficient information.	Abstract is poorly written, unable to clearly connect abstract to research poster or presentation.
Content	Strong material. Well summarized. Clearly shows development of study or research. Material appears to accurately support purpose of study, hypothesis, or research question. Strong conclusion and implications presented.	The content was adequately presented but support for the study, research hypothesis, or question(s) is somewhat general. Conclusion and implications were reasonable.	Connection not found between poster content and purpose of study, research hypothe-sis/question(s), method, conclusions, or implications.

Depth of knowledge	Demonstrates substance and depth; is comprehensive; shows mastery of material, main points were clearly presented.	Covers topic; shows marginaladequate mastery and is objective; main points were adequately presented.	Does not give adequate coverage of topic; poor mastery of subject, main points were poorly presented.
Organization of content	Presentation is strongly ordered and easy to follow; visual elements (if any) are clearly arranged and synchronized with presentation.	Presentation order and clarity is of acceptable quality; slightly difficult to follow; visual elements (if any) are somewhat arranged and synchronized with presentation.	Presentation order and clarity of transitions is of poor quality or below; visual elements (if any) may be difficult to follow or out of synch with the presentation.
Delivery and clarity of presentation	Has natural delivery; modulates voice; is articulate; projects enthusiasm, interest, and confidence.	Has appropriate pace; has few distracting mannerisms; is easily understood.	Is often hard to understand; has voice that is too soft or too loud; has a pace that is too quick or too slow; demonstrates several distracting mannerisms.
Ability to respond to questions	Demonstrates full knowledge of topic; explains and elaborates on all questions.	Shows ease in answering questions but does not elaborate.	Demonstrates little grasp of information; has undeveloped or unclear answers to questions.

Judges

- Daniel Dodson, D.O., Assistant Professor, Clinical Medicine
- Cindy Funk, Ph.D., Professor, Anatomy and Cell Biology
- Kristin Gosselink, Ph.D., Associate Professor and Chair, Physiology and Pathology
- Robert Ketchum, Ph.D., Professor, Anatomy and Cell Biology
- Nancy Minugh-Purvis Ph.D., Professor, Anatomy and Cell Biology
- Richard Ross, M.D., Assistant Professor, Clinical Medicine

Author Index

The journey is tough
yet lightened by a cup of joe
and a dad joke

by Yandry Varela

BURRELL COLLEGE OF OSTEOPATHIC MEDICINE

I am among those who think that science has great beauty.

Marie Curie

Thank you for attending our 4th Annual Medical Student Research Day

Burrell College of Osteopathic Medicine
3501 Arrowhead Dr., Las Cruces, NM 88001
www.burrell.edu