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SOMA Research Conference Abstracts, 2008

All 42 abstracts published here were submitted through the Student Osteopathic Medical Association (SOMA) and were entered in the Student Poster Competition, an annual judged event that takes place during the Poster Session at the AOA Research Conference. Last year's competition took place on Sunday, October 26, in Las Vegas, Nev.

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Osteopathic Manipulative Medicine/ Osteopathic Principles and Practice S11 (SOMA 08-12)

A Pilot Investigation of the Types of Somatic Dysfunctions and Tender Points Associated with Temporomandibular Joint Disorders

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Background: Temporomandibular joint disorders (TMD) are common conditions with symptoms of temporomandibular joint (TMJ) pain, crepitus, and restricted range-of-motion. The most common causes of TMD result from disorders of the muscles of mastication, the articular joint or a combination of the two that lead to malocclusion, bruxism, jaw clenching and articular inflammation. Many dentists, osteopathic physicians and other health care professionals believe that there is a causal relationship between TMD and somatic dysfunctions (SD's) found in the cranial and cervical regions.

Hypothesis: Temporomandibular joint disorders are associated with a predictable constellation of SD's and tender points (TP's) of the cranium and upper spine.

Methods: Male and female subjects (n=10) with a history of TMD underwent a palpatory exam by a single NMM-OMM resident after 6 weeks of conservative exercise therapy with the *Facejogger*[®] (ZTS Trainings & Sportgeräte GmbH), a device used to standardize exercise for TMJ muscles. A Palpation Exam Checklist (PEC) divided into 3 sections: Structural/SD (11 somatic dysfunction types), TP (8 bilateral points) and

TMJ specific patterns (R/L deviation; R/L clicking), was completed for each subject. The degree of SD or TP severity was graded according to the AOA standard scale of 0-3; zero=none and three=severe. The score was collapsed to a binominal variable with 0 equivalent to the absence, and 1-3 equivalent to the presence of SD or TP. The proportion of total pain attributable to each SD or TP was calculated.

Results: Eighty percent of the subjects experienced TP's in the lateral pterygoid and AC7; 90% in the medial pterygoid; and 100% in the masseter muscles. Eighty percent of the subjects exhibited SD at C4; 90% at C2; and 100% at the CT junction, OA, and C3. TP's that exhibited $\geq 80\%$ prevalence accounted for 50.0% of the diagnosed points and 65.4% of total pain experienced by subjects. SD's that exhibited $\geq 80\%$ prevalence accounted for 45.5% of total SD and 64.4% of total severity perceived by the practitioner.

Conclusions: This was a pilot study, limited by small sample size. However it provides statistical support that TMD exhibits a specific pattern of somatic dysfunction, where 64%-66% of SD's and TP's are localized to a minority of diagnosed points. These results seem to indicate that TMD has a distinct SD and TP pattern that is diagnostically relevant for the associated disorder.

S15 (SOMA 08-16)

Correlation Between Cranial Suture Fusion and Somatic Dysfunction

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Osteopathic physicians have an appreciation for the systemic effect of severe somatic dysfunction in patients. However,

the exact effect of the dysfunction on the body is not completely known. It is our hypothesis that cranial suture fusion and obliteration (long assumed by anthropologists to be a linear, predictable degenerative consequence of aging) is potentially best explained as a consequence of reduced mobility caused by somatic dysfunction. The hypothesis was investigated utilizing the Bass donated skeletal collection housed at The University of Tennessee. The Bass collection contains over 500 individuals from a modern population of known age, sex, and race. From the collection a random subset of adult individuals (N=250) was selected for analysis. Any individuals with a past medical history of severe head trauma were excluded. The analysis was conducted in two phases. In the first phase, each of the crania was scored for cranial suture closure following the methodology of Meindl and Lovejoy (1985). 27 cranial landmarks (16 ectocranial, 7 endocranial, 4 palate) were scored on a scale of 0-3, with 0 representing an open suture, 1 being less than 50% ossification, 2 being 50–99% ossification, and 3 representing complete obliteration. The values were then summed to a degree of overall suture fusion. The second phase included an analysis of each skeleton by an osteopathic physician and medical student. Any somatic dysfunction was recorded, including uni-lateral sacroiliac fusion, bi-lateral sacroiliac fusion, vertebral fusion, or ankylosing spondylitis. The strain pattern in the cranium was also noted when present. A statistical regression analysis was conducted to determine if the degree of cranial suture closure of a given individual as related to either age at death, or presence of somatic dysfunction. A significant correlation was not found between suture obliteration and age of the individual ($\alpha=.05$). However, there was a statistically significant correlation between somatic dysfunction and suture closure, with individuals with skeletal dysfunction showing a markedly increased rate of suture fusion and obliteration. The results from this study suggest that there may be a relationship between skeletal somatic dysfunction and cranial suture ossification. This may be indicative in a change in overall mobility resultant from a severe dysfunction, such as sacroiliac fusion, including decreased mobility of the cranial bones.

Reference

Meindl RS, Lovejoy CO. Ectocranial suture closure: A revised method for the determination of skeletal age at death based on the lateral anterior sutures. *Amer J Physical Anthropol* 1985;68:57-66.

S20 (SOMA 08-22)

Salivary IgA Fluctuations in Response to Stress and Osteopathic Manipulative Treatment

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High levels of human salivary sIgA (s-IgA) have been shown to decrease the incidence of acquiring upper respiratory tract infections (URTI). In recent publications, Osteopathic Manipulative Treatment (OMT) has been shown to improve car-

diac indices, increase lymph flow rates through the thoracic duct and decrease sympathetic tone in post-surgical and ICU patients. This information led us to hypothesize that perhaps OMT may also increase IgA levels in people under high levels of emotional and psychological stress, thereby enhancing immunity, and preventing an array of subsequent infections. The objective of this study was to determine if Osteopathic Manipulative treatments have any effect on salivary IgA levels. This open randomized controlled study consisted of 25 second year medical students: 12 students in the experimental group, matched with 13 in the control group. Before the experiment, all subjects submitted a saliva sample for a baseline IgA level. The experimental group went on to receive 20 minutes of OMT, while the control group studied in a separate area for 20 minutes. All subjects submitted a second saliva sample one hour after the 20 minute intervention. The IgA levels for both groups were recorded before the intervention (T1) and after the intervention (T2). Data were analyzed via 2×2 ANOVA GLM for repeated measures. The experimental group, who received OMT, displayed a significantly greater increase in salivary IgA levels after the intervention compared with the control ($p < 0.025$). The study demonstrates the positive effect that Osteopathic Manipulative Treatment has on salivary IgA levels in persons enduring high stress states. This suggests that OMT may then have therapeutic preventative and protective effects on hospitalized patients, especially those requiring ventilator-assistance, as they are subject high levels of emotional and physiological stress, low levels of salivary IgA, and subsequent acquisition of URTI.

Acknowledgment: This experiment received approval from the New York College of Osteopathic Medicine (NYCOM) Institutional Review Board, and funding from NYCOM internal research funds.

S22 (SOMA 08-24)

Comparing Changes in Serum Nitric Oxide Levels and Heart Rate After Osteopathic Manipulative Treatment (OMT) Using the Dalrymple Pedal Pump to Changes Measured After Active Exercise

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Introduction: Release of endothelial nitric oxide, NO, (in nM range) into circulation may play a causative role to enhance the benefits of active aerobic exercise as well as OMT. We compared OMT using the Dalrymple Pedal Lymphatic Pump (DPLP) to active exercise in order to determine their relative effects on serum NO levels.

Hypotheses: We postulate both OMT and aerobic exercise will result in significant NO increases in the nM range when

STUDENT CONTRIBUTIONS

compared to baseline but only active exercise will increase heart rate.

Methods: We recruited 17 healthy subjects (10 male; 7 female; ages 22-27) to perform a randomized sequence of procedures on separate visits at least 3 days apart. Using a supine bicycle, participants engaged in 5 minutes active exercise at 70% maximum heart rate (HR) as calculated by the Karvonean formula. OMT was performed using the DPLP with subjects holding an accelerometer to standardize OMT rate and force employed. During both procedures we used a pulse oximeter to record HR and O₂ saturation. We drew pre- and post- procedure blood samples while the patient sat still and upright for 5 minutes prior to blood draw. The blood was centrifuged and analyzed using a Caymen Chemicals Nitrate/Nitrite Fluorometric Assay Kit.

Results: All subjects demonstrated consistent individual median NO baselines=65-66 nM (range 60-74). Active exercise resulted in an average Δ NO=+2.38 nM ($p=0.004$), Δ HR=+73 bpm ($p<0.0001$), and Δ O₂ saturation=-1.5% ($p<0.0001$). OMT resulted in an average Δ NO=+3.00 nM ($p=0.005$), Δ HR=+0.6 bpm ($p=0.778$), and Δ O₂ saturation=-0.47% ($p=0.048$). DPLP average frequency and peak force were 2.92 Hz and 0.18 G respectively. While HR varied significantly ($p<0.0001$) between OMT and exercise, one factor ANOVA analysis of Δ NO and Δ O₂ saturation levels failed to resolve a significant difference ($p=0.398$) between active exercise and OMT.

Conclusion: This study demonstrates that OMT, specifically DPLP, and active exercise elicit physiologically equivalent NO responses in the nM range. Further study may reveal whether those who are unable to participate in active exercise due to physical limitations have the potential to experience the clinically beneficial aspects of exercise without stressing the heart.

Acknowledgment: AOA 07-10-557 (Kuchera) "Documenting Mechanics and Mechanism in Pedal Pump OMT" and Philadelphia Health Care Trust (Fluorometric analysis equipment)

S32 (SOMA 08-37)

The Presence of Chapman Points in Patients with Acute Chest Pain in the Emergency Department

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Introduction: Chapman's Reflex Points (CRP) are poorly described in patients with acute chest pain.

Methods: A prospective convenience study was conducted on adult patients who presented to the Level 1, tertiary-care ED with an EM residency in place. The research facilitators, all Osteopathic students, received further training in CRP via a

standard video instruction. Data was collected prospectively by 3 facilitators who were blinded to the diagnosis or any patient information. A CRP evaluation form was created and used to screen the following identified CMP: Myocardium, bilateral upper and lower lungs, gall bladder, liver, small intestine and kidneys. The Angle of Louis was used as a CRP control point. The Chapman's reflex points were surveyed with the patient in supine and approximately four grams of pressure was applied. CRP responses were documented as well as patient demographics, treatment, etc. prior to the survey. A total of 11 potential body CRP were evaluated and 5 were specific for the chest and 6 for other body regions. Patients were enlisted into either an experimental group or control group. The experimental group contained patients with a chief complaint of and ultimate diagnosis of abdominal pain as per prestudy criteria. The control group included patients with a chief complaint other than abdominal pain. The CRP and the ED diagnosis were compared to determine if the positive Chapman points were related to the ED diagnosis. All methods and procedures were approved by the Maricopa Integrated Health Systems Investigational Review Board. All methods and procedures were approved by the Maricopa Integrated Health Services IRB. This study was not sponsored. Statistics were calculated with EXCEL™ and STATA™ software.

Results: During the 5 week trial, 180 patients were enrolled in the study after informed consent. A total of 24 (13%) had a final diagnosis related to chest pain. Mean age was 40.4 [19-83] years. Of the patients with chest pain the mean # of chest CRP 1.67 was vs. total 0.67 ($p<.04$). The Kendall tau rank correlation coefficient was -.01 suggested a weak negative association.

Conclusions: In patients with acute chest pain, CRP specific for the chest were more likely to be positive than non-chest points.

S34 (SOMA 08-39)

Changes in Salivary α -Amylase After Osteopathic Manipulative Treatment

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While Osteopathic Manipulative Treatment (OMT) is a widely used treatment modality, little is known about the mechanisms underlying its activity. The identification of salivary biomarkers that change in response to OMT would provide convenient tools to advance this area of research. The purpose of this pilot study was to investigate the feasibility of using salivary biomarkers to study OMT by investigating changes in salivary α -amylase levels in response to rib raising. Rib raising

is a commonly used technique believed to initially increase sympathetic nervous system activity but result in a prolonged reduction of sympathetic outflow. Because salivary α -amylase is a marker of sympathetic activity, it was hypothesized that rib raising would lead to a transient increase in α -amylase levels but have a minimal effect on salivary flow rate. After obtaining IRB approval, 23 healthy adult subjects were recruited and randomly assigned to OMT or placebo groups. The subjects provided saliva samples before receiving rib raising or a light touch control procedure and at two time points after the procedure. Salivary flow rate, total protein concentration and α -amylase activity were measured for each sample. Six subjects were ultimately excluded from the analysis for reasons including undetectable baseline α -amylase activity and the presence of blood in the sample. The first group of subjects ($n=3$ after exclusions) provided saliva samples 10 and 20 minutes after the procedure. Although an initial increase in α -amylase activity was expected, a decrease was seen at both time points in subjects who received OMT. To determine if a rapid initial increase was being missed, saliva samples were collected from the remaining subjects ($n=14$ after exclusions) immediately after and 10 minutes after receiving OMT or placebo. There was a significant decrease in α -amylase activity in the OMT group both immediately after ($p=.014$) and 10 minutes after ($p=0.008$) the procedure. This decrease was independent of changes in flow rate and total protein concentration. No statistically significant difference in α -amylase activity was seen in the placebo group at either time point. Although additional studies with larger sample sizes are needed, these results suggest that salivary α -amylase may be a useful biomarker for OMT.

Acknowledgment: This study was supported by a fellowship from the Student Osteopathic Medical Association.

S39 (SOMA 08-46)

Osteopathic Manipulative Medicine Efficacy on Pulmonary Function as Measured by Spirometry

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Background: The effects of Osteopathic Manipulative Medicine (OMM) in patients with lung pathology are largely unknown. Previous studies have shown conflicting evidence of whether or not OMM is effective in improving lung function.

Objective: To obtain quantifiable Pulmonary Function change in the normal patient population using Spirometry.

Methods: Subjects (11 total; more than 18 years of age with no history of respiratory disease) were involved in a repeated measures design consisting of one OMM treatment and one sham treatment. In this design, each subject acted as their own control. Five OMM techniques directed at treating the tho-

racic cage and diaphragm were chosen for the treatment portion. The sham treatment consisted of sitting in an exam room for an equivalent amount of time. The Pulmonary Function Technologist was blinded to the type of treatment. The time in between visits was at least one week but no more than two weeks. Values measured included FVC, FEV1, FEV1/FVC, PEF, and FEF25%-75%. Data Analysis was performed using SPSS statistics program.

Results: Preliminary results are not showing a statistical significant difference between the sham and treatment groups. However there is a positive trend in FEV1/FVC in the treatment group but statistical significance has yet to be reached.

Conclusions: Preliminary data indicates that OMM may show quantifiable benefits in pulmonary function of healthy adults. Our goal is to continue our study to 64 subjects so that we can reach statistical significance, as suggested by our Power Analysis.

Acknowledgment: This study is supported by the NYCOM OMM Department and NYCOM Academic Health Care Center. In addition, this study is fully approved by the New York Institute of Technology/New York College of Osteopathic Medicine Institutional Review Board.

S40 (SOMA 08-47)

Anatomical Validation of Jones Counterstrain Tenderpoint Nomenclature: A Feasibility Study

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Background: Counterstrain is an OMT technique that relies on specific tenderpoints (TP) to detect and treat somatic dysfunction. The coordinates of each TP have been specifically described. The naming convention of the TP is inconsistent as it relates to specific muscles or cutaneous nerve level innervation or seemingly unrelated structures. To date, there have been no published attempts to physically explore the anatomy underlying these TP to determine if the name of each correlates with the underlying anatomy. The goal of this investigation was to determine if such an investigation is feasible and whether statistical analyses can be applied to an anatomical dissection.

Methods: Using a single, average-built male cadaver, 22 thoracic, lumbar and pelvic TP coordinates were marked and steel pins (1/8" diameter) were inserted at each point, penetrating to bone. A layer-by-layer dissection was performed and all structures within a 5-mm radius of each pin were considered pierced and identified. The sensitivity and specificity was then determined for the tenderpoint name (TN) using the dissected anatomy (DA) as the reference standard. Sensitivity was defined as the frequency of an anatomic TN describing exclusive DA (i.e., single muscle pierced). Specificity was defined as the frequency of a non-anatomic TN describing non-exclusive DA (i.e., multiple muscles pierced).

STUDENT CONTRIBUTIONS

Results: The dissection yielded a clear visualization of anatomical structures and their relationships to each TP marking pin. Overall, TN has 89% sensitivity and 38% specificity (PPV 50%). For muscular points, TN is 100% sensitive and 0% specific (PPV 38%) to the revealed muscles. For points named after cutaneous nerve innervation, TN is 100% sensitive and 0% specific to the revealed nerves (PPV 63%). For unclearly named points (HISL, HFO-SI, MPSI, UP5L, LP5L, LISI), TN is 0% sensitive and 100% specific (NPV 83%). Sensitivity and specificity of the suggested anatomy at these points was 100% and 40%, respectively (PPV 25%).

Conclusion: Cadaver dissection to assess validity of counterstrain tenderpoint names is feasible. The application of statistical analysis to an anatomical dissection is also feasible. By applying sensitivity and specificity statistics to this single cadaver, it appears that TN and SA are not accurate systems of nomenclature for all lumbar and pelvic counterstrain points using anatomy as the reference standard. Further investigation may also aid in teaching of this technique.

S41 (SOMA 08-48)

The Presence of Chapman's Reflex Points in Patients with Acute Abdominal Pain in the Emergency Department

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Introduction: Chapman's Reflex Points (CRP) are poorly described in patients with acute abdominal pain.

Methods: A prospective convenience study was conducted on adult patients who presented to the Level 1, tertiary-care ED with an EM residency in place. The research facilitators, all Osteopathic students, received further training in CRP via a standard video instruction. Data was collected prospectively by 3 facilitators who were blinded to the diagnosis or any patient information. A CRP evaluation form was created and used to screen the following identified CRP: Myocardium, bilateral upper and lower lungs, gall bladder, liver, small intestine and kidneys. The Angle of Louis was used as a CRP control point. The Chapman's reflex points were surveyed with the patient in supine and approximately four grams of pressure was applied. CRP responses were documented as well as patient demographics, treatment, etc, prior to the survey. A total of 11 potential body CRP were evaluated and 4 were specific for the abdomen and 7 for other body regions. Patients were enlisted into either an experimental group or control group. The experimental group contained patients with a chief complaint of and ultimate diagnosis of abdominal pain as per prestudy criteria. The control group included patients with a chief complaint other than abdominal pain. The CRP and the ED diagnosis were compared to determine if the

positive Chapman points were related to the ED diagnosis. All methods and procedures were approved by the Maricopa Integrated Health Systems IRB. This study was not sponsored. Statistics were calculated with EXCEL™ and STATA™ software.

Results: During the 5 week trial, 180 patients were enrolled in the study after informed consent. A total of 44 (24%) had a final diagnosis related to abdominal pain. Mean age was 40.4 [19-83] years. Of the patients with abdominal pain the mean # of abdominal CRP 1.12 was vs. total 1.01 ($p < .1$). The Kendall tau rank correlation coefficient was $-.05$ suggested a very weak negative association.

Conclusions: In patients with acute abdominal pain, CRP specific for the abdomen were slightly likely to be positive than non-abdominal points but this was not statistically significant.

S43 (SOMA 08-51)

Manual Medicine (MM) Physicians Must Develop Their Palpatory Skills in Order to Accurately Diagnose Somatic Dysfunction Prior To and During Treatment

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Hypothesis: It was hypothesized that MM students would use more pressure during thoracic diagnosis and HVLA treatment than MM physicians. A secondary hypothesis was that MM practitioners would use differing pressures while palpating different body types.

Methods: To test the hypothesis 2 physicians (15 patients, 20 treatments) and 2 students (11 patients, 15 treatments) palpated a volunteer and reported the sidebending/rotational motion characteristics of each of the 12 thoracic segments. At the conclusion of the diagnostic session the palpator designated a "worst" segment for treatment. A prototypic Iso-TOUCH® Palpation Monitor System (Neuromuscular Technologies) was developed to provide instrumentation to quantify pressure ranges used by successful practitioners to accurately diagnose and treat somatic dysfunction. This technology utilizes finger, thumb and palm sensors to measure contact pressures during palpation of a given body region. Thrust pressures over the thoracic transverse processes during diagnosis and HVLA were recorded by customized Iso-TOUCH® software. They were then analyzed using a one factor analysis of variance test performed by the PCOM statistician.

Results: Average student diagnostic palpatory force used was 4.83 lbs (left thumb) and 6.8 lbs (right thumb) and 5.97 lbs (l. thumb) and 7.24 lbs (r. thumb) for physicians. The maximum force physicians used was 28.2 vs. 22.42 lbs for students. Thrust time was 0.47 vs. 0.24 seconds. Thrust force was 12.89 vs. 6.87 lbs and area under the curve was 6.7 vs. 1.49 lbs. Student

thrust pressure ranged from 2.37-12.8 lbs while physicians ranged from 5.12 to 23.56 lbs. Physician thrust forces (endo 9.94, meso 13.58, and ecto 13.0 lbs) differed from students (endo 12.8, meso 7.54, and ecto 5.7 lbs) based on body type. Significance ($p < 0.05$) was reached in HVLA measurements however diagnostic pressures and body type did not.

Conclusion: This study does not confirm the hypothesis that students will use more force than physicians to accurately diagnose and treat somatic dysfunction. In fact, in this study the student group used less force than the physician group. Further studies with larger sample sizes and in educational settings are planned to determine if this real-time feedback system may improve palpatory skills of future practitioners.

Clinical Studies

S01 (SOMA 08-01)

Comparing Changes in Serum Nitric Oxide Levels and Heart Rate After Periodic Acceleration Therapy (PAT) Using an AT101™ Table to Changes Measured After Active Exercise

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Background: Release of endothelial nitric oxide, NO, (in nM range) into circulation may play a causative role to enhance the benefits of active aerobic exercise. NO is released through intravascular shear forces by activating endothelial nitric synthase, eNOS. In order to determine their relative affects on serum NO levels, we compared active exercise to a noninvasive, passive procedure purported to supplement circulation by increasing intravascular endothelial shear forces.

Hypotheses: We postulate both aerobic exercise and passive procedures producing periodic longitudinal accelerations will result in significant NO increases in the nM range when compared to baseline but only active exercise will increase heart rate (HR).

Methods: We recruited healthy subjects (10 male; 7 female; ages 22-27) to perform a randomized sequence of procedures on separate visits at least 3 days apart. Using a supine bicycle, participants engaged in 5 minutes active exercise at 70% maximum HR determined by the Karvonean formula. An AT101™ table induced force along the body's longitudinal axis while an accelerometer attached was to the AT101 documenting force and frequency. A pulse oximeter recorded HR and O₂ saturation (O₂Sat) in both procedures. We drew pre- and post-procedure blood samples while the patient sat quietly upright for 5 minutes prior to blood draw. The blood was centrifuged and analyzed using a Caymen Chemicals Nitrate/Nitrite Fluorometric Assay Kit.

Results: All subjects demonstrated individual median NO

baselines=65-66 nM (range 60-74). Active exercise resulted in an average Δ NO=+2.38 nM ($p=0.004$), Δ HR=+73.08 bpm ($p < 0.0001$), and Δ O₂Sat=-1.5% ($p < 0.0001$). AT101 resulted in an average Δ NO=+3.07 nM ($p=0.008$), Δ HR=-1.50 bpm ($p=0.394$), and Δ O₂Sat=-0.13% (not significant). AT101 average frequency and peak force were 2.32 Hz and 0.12 G respectively. While HR varied significantly ($p < 0.0001$) between AT101™ and exercise, one factor ANOVA analysis of Δ NO and Δ O₂Sat levels failed to reveal a significant difference ($p=0.313$) between exercise (bike) and AT101.

Conclusion: This study demonstrates that "passive exercise" with periodic acceleration using an AT101™ table and moderately active aerobic exercise elicit physiologically equivalent NO responses in the nM range from young healthy subjects.

Acknowledgments: AOA Grant 07-10-557; and Philadelphia Health Care Trust (Fluorometry).

◆ S05 (SOMA 08-05)

Sensitivity and Specificity of an Imbalance Test Performed on a Force Plate in Rested and Sleep-Deprived Sample Populations

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Introduction: Balance, an integrated function coordinated by the central nervous system (the integration of visual, vestibular, and sensory/motor control), is affected by various factors such as head trauma and sleep-deprivation (SLD). Individuals with imbalance demonstrate increased sway of their Center of Gravity (COG) over their base of support. Center of Pressure (COP), a metric for COG, can be measured through a force plate (FP) and quantified by the sway amplitude over a given time. The greater the amplitude of COP sway, the less the COP stays in a 0.5 inch sway tolerance circle (STC_{0.5}) over the 30-second test period. Those least capable of balancing would accumulate the least percentage of their test time within the STC_{0.5} (%COP_{0.5}). An empirically-derived test based upon the time COP spent within the STC_{0.5} has been used previously for imbalance due to head trauma (+Test=%COP_{0.5}<94%). This study assessed the test's sensitivity:specificity (S:S) in control and SLD sample populations who are otherwise healthy.

Hypothesis: We hypothesized that more +Tests would be seen in SLD young adults than those who had normal amounts of sleep.

Methods: We recruited 102 healthy subjects (44 men; 58

◆ Indicates posters that won the 2008 Student Poster Competition.

STUDENT CONTRIBUTIONS

women; 22-27 years); each had documented baseline data involving 2-foot stances with eyes open (2FEO) and closed (2FEC) on an IsoBALANCE® FP. Subjects were randomized to SLD<4 hours (22 men; 28 women) or control (23 men; 29 women). Sequential 30-second 2FEO and 2FEC stance trials on the FP were classified as resulting in a +Test or not.

Results: Median pre-existent normal sleep pattern were equivalent: SLD group=6.75 hours (95% CL: 6.53-7.13); control median=7.00 hours (95% CL: 6.89-7.38). For 2FEO, we observed a +Test in 10 control and 6 SLD subjects (S:S=12.5%:80.8%). For 2FEC, we observed a +Test in 8 control and 10 SLD subjects (S:S=20.8%:84.6%). Only 1-2% difference in S:S existed between gender-specific rather than combined populations for this test.

Conclusion: A single night's SLD (<4 hrs) creates no statistically detrimental change in balance as assessed using the selected 94% threshold Test. Sensitivity of this test is low for 2FEO or 2FEC COP sway within a STC_{0.5}. While this threshold might be useful in some populations, it has a low sensitivity for assessing balance in SLD populations as defined in this study.

Acknowledgment: Col. R.T. Dombroski for assistance & key Test parameters.

S07 (SOMA 08-08)

The Correlation Between Left Coronary Artery and Peripheral Arterial Plaque Deposition: A Histological Analysis

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Hypothesis: To determine if the severity of plaque formation within the left coronary artery correlated with the severity of atherosclerotic plaque deposition in peripheral arterial vessels.

Materials and Methods: Samples from the common carotid artery (a.), brachial a., radial a., left coronary a., right coronary a., femoral a., left anterior descending a. and popliteal a. were removed from twenty-nine cadavers with an age range of 61 to 96 and a mean of 84. Specimens were stained with hematoxylin and eosin. A pathologist graded the slides at 40x: vessels with no plaque (Grade 0), with 1-25% of plaque within the vessel wall (Grade 1), with 26-50% (Grade 2), with 51-75% (Grade 3), and with 76-100% (Grade 4). Correlations of vessel grades were determined using Pearson's correlation coefficient (r).

Results: The correlations of plaque formation were determined: carotid a. vs. left coronary a. (p=0.47; r=-0.18), left coronary a. vs. brachial a. (p=0.35; r=0.076), left coronary a. vs. popliteal (p=0.18; r=0.19), left coronary a. vs. radial a. (p=0.14; r=0.217), left coronary a. vs. femoral a. (p=0.45; r=0.03), left coronary a. vs. right coronary a. (p=0.0007; r=0.717), left coronary a. vs. left anterior descending a. (p=0.06; r=0.316). Plaque was present in the following samples: 9/28 (32%) common carotid a., 20/26 (77%) left coronary a., 21/27 (78%) right

coronary a., 8/11 (73%) left anterior descending a., 3/24 (13%) brachial a., 20/28 (71%) popliteal a., 10/25 (40%) radial a., 21/28 (75%) femoral a.

Conclusions: Intima-media thickness (IMT) has been proposed as a quantitative index for monitoring the disease progression of atherosclerosis.¹ Previous studies have shown the significance of IMT, presence of stenosis, and presence of plaques using B-mode ultrasound.² Other literature has theorized that the presence or absence of plaque and not IMT is a more relevant indicator of early atherosclerosis.³ We attempted to microscopically determine if the presence of plaque within the left coronary artery correlated with the presence of plaque in the sampled arteries. We concluded that no correlation exists. Only the right coronary artery correlated strongly with plaque formation in the left coronary artery. These findings indicate further research efforts should be focused on the significance of IMT and not atherosclerotic plaque deposition.

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S08 (SOMA 08-09)

The Presence of MRSA in Physical Locations in the Emergency Department

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Introduction: Methicillin Resistant Staphylococcus aureus infections are common presentations in the Emergency Department (ED). Current wound cultures in our ED, in the setting of purulent skin and soft tissue infections have been <85% MRSA positive. The purpose of this study is to measure prevalence of MRSA in common areas of the ED.

Methods and Materials: This study was conducted by research facilitators who were trained to obtain bacterial samples from common areas of the ED. Sterile swabs moistened with normal saline were used to collect the samples simultaneously rotating and zigzagging across the surface area to cover as much surface area as possible. A total of twenty samples were obtained from areas used heavily by both physicians

and nurses. Examples include: medication dispensers, stretchers, phones, computer keyboards, etc. The sampling was done on July 8th, 2008 in the late afternoon, one hour before housekeeping was due for routine cleaning of the ED. The swabs were streaked and plated on blood, chocolate and MacConkey™ agar at 37°C in a CO₂ environment. The plates were read at 24 hours, 48 hours, and a final report was made after 72 hours of growth.

Results: Of the twenty samples taken, two had no growth, 17 grew non-pathogenic bacteria such as normal skin flora, and one sample grew a nonresistant strain of *Staphylococcus aureus*. The only positive sample was obtained from a blood pressure cuff in the triage area of the ED.

Conclusion: In our study MRSA is not an organism commonly found in the physical structures in Maricopa County ED, despite a high rate among patients with skin and soft tissue infections. Further research should include a greater number of samples and a larger diversity of areas swabbed.

S09 (SOMA 08-10)

Effect of Fructose Versus Complex Carbohydrate Diet on Hepatic Glucose Fluxes and UDP-Glucose Turnover in Humans

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Hypothesis: Animal studies have shown that compared to glucose, fructose is a more effective substrate to replenish hepatic glycogen stores (HGS). We hypothesize that the difference in HGS after 9 days of fructose rich diet will increase fasting glucose production (GP) and decrease hepatic glycogen flux (HGF) during a hyperinsulinemic-euglycemic clamp when compared to a 9-day complex carbohydrate diet.

Methods: Healthy volunteers were admitted to SFGH for an 18-day inpatient stay. Half of the subjects were fed a complex carbohydrate (CHO) diet (50% energy from CHO, 35% from fat, and 15% from protein) for 9 days followed by 9 days of an iso-energetic diet (fructose replaced 50% of the CHO) while the other half started with high fructose diet followed by complex CHO. During days 7 and 16, subjects underwent intensive stable isotope tracer and acetaminophen infusions to measure HGF in fasting state and during the clamp. D-galactose-1d (deuterium-labeled) was used to label UDP-glucose, which in turn was sampled by acetaminophen serving as a "pharmacological probe". Acetaminophen glucuronide (GlcUA) is subsequently excreted in the urine. HPLC was utilized to detect and isolate the labeled GlcUA from urine. The GlcUA was collected and derivatized for GC/MS analysis. HGF was calculated by the tracer dilution method.

Results: Fasting GP was increased in the fructose diet group

(1.91 ± 0.07 vs. 1.59 ± 0.23 mg/kg*min; $p < 0.07$) and suppressed similarly for both diet during the clamp (66% and 64% respectively). During the clamp HGF were decreased (0.87 ± 0.11 vs. 1.02 ± 0.09 mg/kg*min; $p < 0.02$) for the fructose group. Both hepatic glucose uptake and glucose made by gluconeogenesis contributed to HGF and both components were decreased after the fructose rich diet (0.56 ± 0.08 vs. 0.67 ± 0.06 , $p < 0.02$ and 0.31 ± 0.04 vs. 0.35 ± 0.04 mg/kg*min, $p < 0.07$, respectively).

Conclusions: We quantified fasting GP and HGF after three hours of hyperinsulinemic-euglycemic clamp. Our preliminary data are consistent with the hypothesis that larger HGS after fructose rich diet lead to an increased fasting GP and decreased HGF during the clamp. Fructose rich diets impact hepatic carbohydrate metabolism.

Sponsors: Touro University, NIH R01DK078133, ADA1-08CR56. Approved by Touro University and UCSF IRBs.

S19 (SOMA 08-21)

Behavioral Phenotyping in a Knock-in Mouse Model of Huntington's Disease

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Huntington's disease is a neurodegenerative disorder in which one of the pathological characteristics is selective atrophy of the striatum. Symptoms of the disease also include a variety of motor, cognitive, and emotional disturbances. We assessed the motor skills of an HDh 140 model knock-in mouse that exhibits the human disease condition pathologically in its selective cell loss to the striatum. The scientific community has scarcely approached characterizing the behavioral phenotype in these knock-in mice. We tested six 9-month-old HD knock-in mice and six wild-type control mice in a series of behavioral phenotype assessments that allowed us to quantify their motor skills using 5 measures: gait length and width, grip strength, wire maneuver, seconds on a rotarod, and the display of natural behavior in an open field through the Noldus Ethovision videotaping system which tracks the animal's speed, direction, and trajectory. The data show a trend for increased rearing with age and a trend for a weaker grip strength in the mutants. The trend in the open field testing was that HD knock-in mice had an affinity for the field peripheries and groomed for a longer duration when compared to control mice which suggests both motor and emotional dysfunctions in knock-in mice. These trends are important because they suggest motor and emotional symptoms in this mouse model of Huntington's disease. On the other hand, the footprint analysis, wire maneuver, and the coordination on the rotarod did not reflect any difference

between the genotypes. The absence of any statistically significant differences in any of the tests may be due to the possibility that the mice were studied too early in the development of Huntington's disease, or there was not a big enough sample. Future research in the behavior of these mice should study larger groups, and determine correlations between the pathology of these mice and the variability of their behavior.

S27 (SOMA 08-29)

Can a Nutritional Matrix be Utilized to Assess Obesity?

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Background: Obesity is a primary problem affecting one out of three West Virginia residents. Based on our observations and the need for a better understanding of obesity in West Virginia, we conducted a study to evaluate the relationship between nutrition and lifestyle variables and obesity.

Hypothesis: Lifestyle variables, as measured by a nutritional matrix based on three lifestyle components, will identify a relationship to obesity using Body Mass Index (BMI) as a measure of obesity.

Materials and Methods: This IRB approved study targeted attendees at the health fair at the State Fair of West Virginia. This project was part of a community intervention program that offered nutritional counseling to those interested in changing their nutritional status. A standardized data collection form was created with questions focused on level of exercise and dietary habits.

Results: The survey was completed by 1576 participants ranging 18-92 years at the State Fair of West Virginia in August, 2007. Participants were classified into a "poor" nutritional category or a "good" nutritional category using a matrix based on three parameters: activity level, consumption of fast food, and the consumption of empty kilocalorie drinks. Based on our matrix, 591 participants were categorized into the poor nutritional category; with the remainder 985 participants were classified into the good nutritional category. Multiple logistic regression analysis was performed between the poor nutrition group and the good nutrition group. Multiple logistic regression analysis is a statistical test used for analyzing dichotomous response variables. Logistic regression analysis yields an adjusted odds ratio for 95% confidence interval. Our analysis revealed a significant relationship between obesity and poor nutrition with an adjusted odds ratio (95% confidence interval) of 1.046 (1.022-1.071) with a p value <0.001.

Conclusion: In summary, we were able to show a relationship between poor nutrition and obesity. We were also able to use three parameters to define a nutritional matrix that relates to obesity. One limitation to our study is the non-random patient sample obtained from the State Fair of West Virginia. Based

on our findings we conclude that with a simple nutritional matrix we could potentially ascertain the relative risk of being obese.

Sponsor: West Virginia School of Osteopathic Medicine.

S29 (SOMA 08-34)

A Pilot Study Comparing Facial Exercise versus Pulsed Signal Therapy to Treat Patients with Temporomandibular Joint Disorders (TMD)

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Introduction: Temporomandibular joint (TMJ) disorders are common conditions with symptoms of TMJ pain, crepitus, and restricted range-of-motion (ROM). Exercise and pain reduction are commonly used strategies for managing TMD symptoms. We used a German-made (ZTS Trainings & Sportgeräte GmbH) device, *FaceJogger*[®] (FJ), to standardize exercise for TMJ muscles and an FDA-approved pain reduction device, Therapeutic Magnetic Resonance (TMR), a form of Pulsed Signal Therapy (PST) as conservative interventions to compare each strategy.

Hypothesis: A 6-week conservative care strategy of thrice daily self-treatment with FJ will be more effective than weekly in-office PST treatment with TMR.

Methods: Subjects (n=21) with a history of TMD were randomized into two groups, Exercise (n=11) and PST (n=10). Intervention for the Exercise group involved a series of mandibular exercises performed with FJ three times daily for six weeks. PST subjects received one session of TMR treatment per week for six weeks. Pre- and post- intervention data were obtained once weekly for each subject using a palpation examination for somatic dysfunction (SD) including tenderness at 14 craniocervical sites, video ROM measures and a resonance measure from diagnostic-mode TMR. Data were analyzed comparing SD load (SDL), Tender Point Total (TPT), maximum ROM and change in resonance level (ΔR) immediately before and after interventions.

Results: Fifteen subjects (Exercise n=10, PST n=5) completed this part of the study. A decrease in SDL was measured for both groups (averaging 4.0% with Exercise; 13.8% with PST); the Exercise group reaching significance (p=0.049) but PST showing only a trend (p=0.072). TPT decreased in both Exercise and PST groups (averaging 0.5% and 10.8% respectively) but failed to reach significance for either. No significant change in ROM was observed in either group. ΔR increased immediately after each intervention (Exercise p=0.007; PST p \leq 0.001).

Conclusions: Facial exercises and PST (TMR) are both effective

tive strategies in increasing tissue resonance values in TMD. Exercise reduced somatic dysfunction load, while TMR demonstrated a trend toward doing so. The results of this pilot study, limited by a small sample size, lay the groundwork to further investigate the efficacy of TMR and FJ as treatment options for TMJ disorders.

Acknowledgment: CIR Systems, Inc.

S33 (SOMA 08-38)

Prevalence of Serrated Adenomas: A Cadaver Study

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Purpose: The purpose of our study was to determine the prevalence of serrated adenomas in a cadaver population and enhance awareness of serrated adenomas, their definitions, and diagnostic criteria.

Materials and Methods: The study was performed on nineteen cadavers in the New York College of Osteopathic Medicine anatomy laboratory. The location and size of each polyp was recorded before it was removed. Each polyp was placed in 10% formalin, processed using Boiwin's solution as a mordant for nuclear staining, and stained with Hematoxylin and Eosin. Histologic analysis was performed by a pathologist and confirmed by a second pathologist using the criteria set forth by Torlakovic in 2003.¹ Polyps were grouped into four categories: adenomas (tubular, villous, or tubulovillous), hyperplastic polyps, serrated adenomas (sessile or traditional), or others. A gastrointestinal pathologist also confirmed any serrated adenoma diagnoses.

Results: Seventeen out of nineteen (89.5%) cadavers were found to have polyps. A total of twenty-six polyps were removed for analysis. There were determined to be one serrated adenoma, fourteen adenomas, five hyperplastic polyps, and five "other" polyps. The calculated prevalence of serrated adenomas in our sample is 5.3%.

Conclusions: Previous research has demonstrated a serrated adenoma prevalence ranging from 0.8 to 9%.^{2,3,4} Our prevalence of 5.3% falls within that range and is most consistent with the research conducted by Spring in 2006, which demonstrated a prevalence of 7.2%.⁴ Our study is significant because the diagnostic criteria for serrated adenomas is not yet firmly standardized and the lack of consistency may lead to misdiagnosis.⁵ In addition, many studies have demonstrated that the molecular pathway from serrated adenoma to carcinoma is different and possibly more rapid than the traditional adenoma-carcinoma pathway.^{6,9} Furthermore, serrated adenomas have a greater association with the occurrence of multiple polyps, which increases one's susceptibility to carcinoma.⁹ Further information regarding serrated adenomas, including prevalence, is clinically important for proper diagnosis, treatment, and surveillance.

Acknowledgment: This study was sponsored by New York College of Osteopathic Medicine Office of Research.

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S35 (SOMA 08-40)

Sleeping Position and Musculoskeletal Pain During Pregnancy

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Hypothesis: Recently, physicians in the obstetric realm have been recommending the avoidance of supine sleeping position during pregnancy with the fear of harm to mother or fetus from vena cava compression by the gravid uterus. Since this most recent push towards lateral position, we have noticed an increase in complaints of musculoskeletal pain, especially hip pain, among patients that present for obstetrical care. We postulated that there is a relationship between new onset musculoskeletal pain and sleeping position during the last trimester of pregnancy.

Materials and Methods: Over a three week period 43 women in their third trimester or post-partum completed a voluntary survey in an outpatient obstetrical clinic. The questionnaire solicited information concerning the position in which the women fell asleep and awoke, as well as levels of pain and discomfort throughout pregnancy.

Results: Of the 43 women who completed the survey, 75.8% of women who awoke on their side reported a significant increase in hip pain in the last trimester over the first two trimesters, compared to only 28.6% of women who awoke on their back (P=0.045). However, when quantified on a scale of one to ten the average difference in hip pain between the two groups was not found to be significant (P=0.99). There was

no significant difference in low back pain change between the groups ($P=0.41, 0.54$).

Conclusions: We conclude that there is likely a relationship between side sleeping and hip pain during the last trimester of pregnancy. There does not appear to be a correlation between low back pain and sleeping position. Further studies with more subjects may be helpful to confirm these results.

Acknowledgment: We thank Dr. Glenn Leavitt D.O. and the staff at Leavitt Women's Healthcare for their cooperation and help with this study.

S38 (SOMA 08-45)

Pyospermia and Urinary Tract Symptoms in Adults With a History of Posterior Urethral Valves

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Purpose: Boys with surgically ablated posterior urethral valves (PUV) may have urinary and sexual problems. Backpressure proximal to a PUV causes changes to the urinary tract and possibly sex accessory glands. Adult patients with a history of PUV and dysuria were selected to evaluate the status of their urogenital anatomy and semen parameters.

Materials and Methods: 29 male patients, age 17 to 51 (mean 21.5 yrs), with a history of ablated posterior urethral valves. Medical history, physical, and genitourinary examination were performed. Incidence of urinary tract infection (UTI), epididymitis, urethritis, urinary frequency, vesicoureteral reflux (VUR), hematuria, and dysuria were noted. Laboratory testing, ultrasonography, and voiding cystourethrogram (VCUG) noted; bladder diverticula, bladder trabeculation, bladder volume and wall thickening, and post-void residual (PVR). Magnetic resonance imaging of the bladder, prostate, seminal vesicles, and ejaculatory ducts were performed on ten patients with severe, intractable incontinence and urinary frequency. Ultrasound imaging of the bladder, kidneys, and testes, as well as semen analysis and culture, serum levels of FSH, LH, and testosterone were obtained.

Results: The most common on-going symptoms in these patients were of inflammation, pain, and infection: 62% (18/29) of patients were treated for epididymitis and 66% (19/29) were treated for urethritis. Forty-one percent (12/29) had a history of UTI. Of the eight patients who had semen cultures performed, 88% (7/8) showed significant bacterial growth and pyospermia. On semen analysis, 38% (3/8) of the patients had profound decreases in sperm count, 63% (5/8) had significant decreases in motility, and 50% (4/8) had significant decreases in normal forms. One patient had a vasectomy, though he has no history of paternity. All (8/8) of the patients'

FSH and LH values were within normal range. Total testosterone levels were low in one patient (1/8). Enuresis was a common complaint, fifty-two percent (15/29) had nocturnal enuresis (NE); 31% (9/29) had diurnal enuresis (DE). Twenty-eight percent (8/29) had both NE and DE. Forty-five percent (13/29) complained of urinary frequency; 52% (15/29) had dysuria. On ultrasound examination, 69% (20/29) had evidence of poor bladder emptying. On VCUG, 34% (10/29) had bladder diverticula and trabeculation, 41% (12/29) showed bladder wall thickening, 17% (5/29) had VUR, hematuria in 38% (11/29), and small bladder volume in 17% (5/29). Elongation of the prostate was notable on MRI when evaluating the prostate and seminal vesicles.

Conclusion: Backpressure proximal to a PUV causes changes in the entire urogenital tract. Increased rate of infection may lead to pyospermia. WBCs in the semen may pathologically attack sperm cells via reactive oxidative species (ROS). This previously unreported finding of pyospermia and bacterial growth in semen may have profound impact on fertility.

Basic Sciences

S02 (SOMA 08-02)

The Effects of the HIV Tat Protein on P-Glycoprotein and CYP3A4 in Intestinal Enterocytes

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The HIV regulatory protein Tat (*trans*-activating transcriptional activator) plays a pivotal role in viral infection and has been shown to upregulate the expression of P-glycoprotein (Pgp). Pgp is an ATP-dependent efflux pump that transports substances from the cytoplasm of enterocytes back into the intestinal lumen. Pgp plays an important role in the distribution and elimination of oral antiretroviral therapy for HIV treatment. Another important factor in efficacy and clearance of antiretroviral therapy is cytochrome P450 3A4 (CYP3A4). CYP3A4 is involved in the metabolic clearance of many drugs and accounts for ~70% of total cytochrome P450s in the small intestine. To date, there has been minimal research examining the effects of Tat on CYP3A4. The effects of HIV infection on Pgp and CYP3A4 expression and function in enterocytes are not well understood. Our specific aim is to better understand the relationship of HIV-1 Tat on Pgp and CYP3A4 expression in enterocytes. Because Pgp expression has been previously shown to be upregulated in infected lymphocytes, our hypothesis is that Pgp and CYP3A4 will be upregulated in enterocytes due to Tat expression. This study was conducted using pcDNA3.1 (negative control) and pcDNA3.1-FLAG-Tat plasmids. Both plasmids were transfected into Caco-2 cells and Tat expression was confirmed by immunoblotting analysis. Tat effects on Pgp and CYP3A4 expression were examined by immunoblotting. Preliminary data did not show

evidence of HIV-1 Tat regulating CYP3A4 expression in Caco-2 cells, even though research in our lab has demonstrated upregulated CYP3A4 in intestinal samples of HIV infected patients. It is possible that the upregulation could be caused by other HIV protein(s). We are currently optimizing our experiments with Pgp and expect results soon. As the number of cases of HIV-infected persons increases, the virology and pharmacology of HIV infection has taken on greater importance. The significance of understanding the role of HIV-1 Tat in Pgp and CYP3A4 expression in enterocytes remains a crucial step in the improvement of drug therapies for HIV/AIDS.

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S03 (SOMA 08-03)

The Response of the *Salmonella Typhimurium* Prophages to Environmental Stress

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Salmonella Typhimurium, a foodborne illness causing pathogen, is the cause of new outbreaks every year. The virulence of bacterial strains is determined by the expression of virulence factor genes located either on the chromosome or on transferable elements, such as prophages. In a host harboring multiple prophages such as *Salmonella*, the reassortment of such factors plays a major role in the emergence of new pathogens and consequently new epidemics. Since this gene transfer depends on prophage induction and the subsequent pool of new bacteriophages particles released, we decided to test the effects of environmental stress on phage release. We developed a quantitative real-time PCR assay to quantify variations in phage genes copy number associated with initiation and/or completion of the lytic cycle. The induction of the four *Salmonella enterica* serovar Typhimurium LT2 prophages (Fels-1, Fels-2, Gifsy-1 and Gifsy-2) was measured during exponential growth, stationary phase, starvation (from 24 hours to 3 weeks), and after treatment with Mitomycin C (2 μ g/ml), Ampicillin (100 μ g/ml) and heat (43°C). Our results show that not only the four prophages have different levels of spontaneous induction in fast growing cells in rich media, they also respond differently to heat, antibiotic treatments and starvation with an increase, a decrease or no change in copy number depending on the stress they were exposed to. These findings show that the transfer of fitness and virulence genes can respond to and depend on different types of environmental stress, which may contribute to the appearance of new *Salmonella* outbreaks.

Acknowledgment: This work is supported by Touro University.

S04 (SOMA 08-04)

Effect of Simvastatin on NOS and Angiotensin Receptor Expression in the RVLM and PVN

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Chronic Heart Failure (CHF) is a major worldwide health concern and has been shown to be associated with an increased sympathetic outflow. HMG-CoA reductase inhibitors (statins) decrease sympathetic outflow in CHF conditions. We hypothesize that simvastatin administered through intracerebroventricular (icv) infusion exerts beneficial effects on autonomic function in CHF by upregulating nNOS, eNOS, and AT₂ receptor protein expression while downregulating AT₁ receptor protein expression. 30 male New Zealand White rabbits were divided into four groups: sham infused with simvastatin (SIM), sham infused with vehicle (VEH), CHF infused with SIM, and CHF infused with VEH. All rabbits received identical surgical instrumentation for pacing and CHF groups were chronically paced at 360 to 380 bpm. Echocardiography was used to monitor cardiac function. Western blotting was used to measure protein expression of nNOS, eNOS, and AT₁ receptor, and AT₂ receptor in the paraventricular nucleus, rostral ventrolateral medulla, and cortex. CHF rabbits had greater heart-to-body weight ratios (2.9 \pm 0.2) as well as lower ejection fractions (41.6 \pm 1.6%) and fractional shortenings (18.8 \pm 0.8%) than sham rabbits (2.2 \pm 0.1 g/kg, 71.3 \pm 2.1%, and 36.7 \pm 1.5% respectively). In the PVN, CHF-SIM rabbits had greater nNOS and eNOS protein expression and lower AT₁ receptor protein expression than CHF-VEH rabbits. In the RVLM, CHF-SIM rabbits had greater nNOS, eNOS, and AT₂ receptor protein than CHF-VEH rabbits. The cortex served as a control area of the brain and SIM treatment did not modulate NOS or Angiotensin receptor protein expression in CHF. These findings provide incite into potential mechanisms by which statins attenuate the increase in sympathetic outflow experienced during CHF.

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S06 (SOMA 08-06)

Increase in Antibiotic Resistance Among *bla*_{CMY-2+} *Salmonella Typhimurium* After Empirical Ceftriaxone Therapy and Novel Treatment Approaches

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Salmonella typhimurium is an important and prevalent pathogen in humans with fluoroquinolones or Ceftriaxone being recommended treatments for invasive infections. *Salmonella* strains have shown increasing prevalence of the plasmid-encoded *bla*_{CMY2} gene which induces resistance to

STUDENT CONTRIBUTIONS

cephalosporins. The plasmid also carries a range of other antimicrobial resistance genes making the organism multiple drug resistant. Due to increasing concern over the use of fluoroquinolones and the increase in resistance to third generation cephalosporins, it is important to determine the efficacy of empirical Ceftriaxone therapy and to search for alternate therapy. This experiment was designed to study the effects of Ceftriaxone therapy on the growth, pharmacodynamics, and resistance of *bla*CMY2+ *Salmonella typhimurium* isolates to various antimicrobials. Three *bla*CMY2+ *S. typhimurium* isolates, G046, G047, and G052 were found to have the following minimum inhibitory concentrations; 128 µg/ml for Ceftriaxone, 64 µg/ml for azithromycin and for gentamicin MICs varied with 1-2 µg/ml, 8 µg/ml, and <256 µg/ml for strains 052, 047, and 046, respectively. Strains were subjected to a Ceftriaxone dilution scheme ranging from 151 ug/ml to 28 ug/ml mimicking serum concentrations during 12 hrs of patient treatment, subsequently isolates were stored for further analysis. Growth rate was not altered post-Ceftriaxone exposure, however the MICs to all drugs, Ceftriaxone, azithromycin, and gentamicin increased markedly in all three strains as a result of Ceftriaxone treatment. The three original isolates were further subjected to antimicrobial combinations of Ceftriaxone/azithromycin and Ceftriaxone/gentamicin, both pre- and post-Ceftriaxone exposure. Pre-exposure Ceftriaxone/azithromycin proved to be inhibitory for all strains at 32 µg/ml Ceftriaxone and 8 µg/ml azithromycin, and Ceftriaxone/gentamicin inhibitory at 64 µg/ml Ceftriaxone and 0.5 µg/ml gentamicin. However, post Ceftriaxone exposure MICs increased to both combinations. This data indicates that the treatment of *bla*CMY2+ *Salmonella* with standard empiric Ceftriaxone therapy increases the resistance not only to Ceftriaxone, but to azithromycin and gentamicin as well, thus reducing the likelihood of a positive clinical response. However, the data indicates combinations of Ceftriaxone/azithromycin or Ceftriaxone/gentamicin show synergy and may be more effective as empiric therapy for invasive Salmonellosis.

◆ S12 (SOMA 08-13)

Membrane Estrogen Receptors Interact with Metabotropic Glutamate 1a Receptors in Hypothalamic Astrocytes to Induce the Synthesis of Progesterone in Hypothalamic Astrocytes

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Progesterone is produced in the adrenal glands, the gonads, the brain, and the placenta during pregnancy. Ovarian estradiol induces the synthesis of progesterone in hypothalamus that is essential for estrogen positive feedback resulting in a Luteinizing Hormone (LH) surge. Progesterone synthesis in astrocytes is mediated by estradiol acting on membrane estrogen receptors (mER) to increase free cytoplasmic calcium concentrations ($[Ca^{2+}]_i$). To understand the mechanism of membrane estradiol signaling we tested whether mER interacted with mGluR1a to induce ($[Ca^{2+}]_i$ flux and progesterone synthesis. First, the potential interaction was established using co-immunoprecipitation of mER and mGluR1a. Second, $[Ca^{2+}]_i$ flux in astrocytes was monitored with the calcium indicator, Fluo-4, and imaging performed on a Zeiss-510 Meta laser scanning confocal microscope. 17β-estradiol at 1 nM, 10 nM, and 100 nM induced a similarly robust $[Ca^{2+}]_i$ flux of 612 ± 42 relative fluorescent units (RFU) (n=15), 641 ± 47 RFU (n=18), and 629 ± 34 RFU (n=16), respectively. These responses were all significantly greater than estradiol at 100 pM with $[Ca^{2+}]_i$ flux of 282 ± 18 RFU (n=25, $p < 0.001$). However, even estradiol concentration as low as 100 pM induced a greater $[Ca^{2+}]_i$ flux than controls at 134 ± 16 RFU (n=14, $p < 0.001$). Blockade of mGluR1a with the selective antagonist, LY367385 (20 nM), attenuated the estradiol (1 nM)-induced $[Ca^{2+}]_i$ flux from 639 ± 63 RFU to 186 ± 56 RFU (n=5, $p < 0.002$).

In conclusion, the mER interaction with mGluR1a is necessary to mediate cytoplasmic calcium signaling in hypothalamic astrocytes. The increase in ($[Ca^{2+}]_i$) is critical to induce progesterone synthesis in the brain.

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S13 (SOMA 08-14)

Activational Effects of Gonadal Steroids on Energy Homeostasis

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Background: The ability of gonadal steroids to modulate energy homeostasis has long been noted in humans and in a variety of animal models. For example, women exhibit less energy intake during the estrogenic periovulatory phase of the reproductive cycle. In addition, estrogen lowers body temperature, an antichlimatectic side effect of estrogen replacement therapy. Conversely, the anabolic effects of androgens increase energy intake, weight gain, and muscle mass, thus making them effective in treating cachexia due to cancer and

◆ Indicates posters that won the 2008 Student Poster Competition.

HIV/AIDS. Many prior studies examining the effects of gonadal steroids on feeding behavior relied solely on gross intake as the index. The purpose of this study was to better characterize the effects of gonadal steroid hormones on the microstructural elements of feeding behavior and core body temperature.

Hypothesis: Gonadal steroid hormones modulate feeding behavior by producing changes in daily and hourly intake, and meal frequency, duration, and size.

Methods and Materials: Under anesthesia, gonadectomies on female and male guinea pigs were performed alongside abdominal implantation of data loggers used to monitor core body temperature. Animals were allowed to recover for 4 days, followed by a 3 day period of acclimation to daily handling, weighing and living in an automated feeding chamber. For 7 days five indices of feeding behavior mentioned above were then monitored 24 hours per day, and the animals were subject to injection regimens consisting of one s.c. injection every other day of ipsilateral sex hormone (estradiol benzoate (EB; 4 and 10 μ g) or testosterone propionate (TP; 400 μ g)) or vehicle. Animals had unlimited access to chow. Data analysis and statistical evaluation by ANOVA was followed by the Least Significant Difference (LSD) test.

Results: EB-treated females had significantly decreased gross intake and weight gain in addition to lowered hourly intake, frequency, and body temperature but increased meal duration and size at most time points compared to vehicle. By contrast, male guinea pigs treated with TP had significantly higher gross intake and weight gain compared to vehicle, and displayed hourly increases in intake, meal duration and size.

Conclusions: Ovarian estrogens and testicular androgens display distinct activational profiles on feeding behavior and core body temperature; in keeping with their modulatory roles in regulating energy homeostasis.

Acknowledgment: This study was sponsored by the Western University IMRA.

S14 (SOMA 08-15)

Dynamic Assessment of Biomechanical Factors Implicated in the Development of Medial Tibial Stress Syndrome

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Background: Medial tibial stress syndrome (MTSS) is a common injury that many athletes develop. Defined as pain along the postero-medial, distal two-thirds of the tibia (Kortbein et al., 2000), MTSS has been linked with excessive fascial traction. This excessive traction may be caused by over-pronation of the foot (Sommer and Vallentyne, 1995), which causes greater bending moments about the tibia. Although a biomechanical factor may be implicated in the development of MTSS, studies investigating these factors have mainly been

conducted during static standing, and it may be that static foot posture is not correlated with dynamic motion (Thijs et al, 2008).

Goal: Thus, the purpose of our study is to look at the forces distributed across the lower leg during running in relation to the movements of the foot in an effort to estimate the bending moments about the tibia.

Methods: We examined the biomechanics of the foot and leg during running using a 3D motion analysis system (Innovision Systems, Columbiaville, MI) and an AMTI force plate (OR6-7-2000; AMTI, Inc. Watertown, MA). Prior to running, markers were placed on bony landmarks to facilitate tracking the foot and leg. Degree of pronation was assessed using navicular drop and the position of the navicular in relation to the Feiss line (McProil and Brocato, 1990). Spearman rank correlation coefficients were calculated for medio-lateral forces compared to navicular drop and compared to the Feiss method.

Results: Results show that navicular drop is positively correlated with greater lateral forces throughout the stride (range: 0.657-0.880). The Feiss assessment, although more variable, also shows that greater pronation of the foot is associated with greater medio-lateral forces (range: 0.314-0.700).

Conclusions: In any axis, higher forces should contribute to an overall higher ground reaction force (GRF) experienced by the tibia. Specifically, greater medio-lateral forces should angle the GRF further from the postero-medial aspect of the tibia, causing greater bending moments along this aspect. Although indirect measures of bending moments along the postero-medial distal two-thirds of the tibia, our results support previous biomechanical studies of foot motion (e.g. Simpson and Jiang, 1999) and specifically support the idea that over-pronation of the foot may be related to the development of MTSS.

Acknowledgment: This research was supported by a WVSOM intramural grant and approved by the WVSOM IRB (#JH12012007).

S16 (SOMA 08-17)

The Role of Fas in Myocardial Ischemia Reperfusion Injury in Mice

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Background: Periods of myocardial ischemia followed by reperfusion of the ischemic tissue have been associated with both acute and long-term myocardial damage. One event that may contribute to the damage is activation of the death receptor, Fas. Stimulation of Fas by Fas ligand (FasL), however, can lead to either apoptosis or hypertrophy. Therefore, the hypothesis to be tested in this study is: Ischemia followed by reperfusion causes increased Fas activation and that disruption of FasL-Fas interaction during reperfusion can prevent

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apoptosis and alter the subsequent development of hypertrophy and cardiac remodeling.

Materials and Methods: Mouse cardiac myocytes (HL-1 cells) were subjected to 2 hours of simulated ischemia followed by up to 24 hours of reperfusion. Cells were treated with either Kp7-6, a Fas-disabling small exocyclic peptide, or vehicle during reperfusion and apoptosis was assessed by measuring caspase 3 activity. An in vivo mouse model was used to determine the effect of Fas on ischemia reperfusion (IR)-induced activation of the hypertrophic signaling pathway. Ischemia was induced by occluding the left anterior descending artery for 30 minutes followed by up to 2 hours of reperfusion. Three minutes before reperfusion the mice received an intraperitoneal injection of either Kp7-6, or vehicle control. The hypertrophic pathway was assessed by measuring the phosphorylation and hence activation state of Akt and one of its downstream targets, GSK-3beta, by western blotting.

Results: Simulated IR of HL-1 cells activated caspase 3, an effect which was inhibited by the Fas antagonist. In vivo, IR caused a transient activation of Akt and GSK-3beta, which peaked at 15 minutes and was reduced by 2 hours. This effect was augmented by inhibiting Fas activation with Kp7-6.

Conclusion: Following a myocardial infarction, not only does cell death occur via both apoptosis and necrosis, but pathways leading to myocyte hypertrophy are also activated. These ultimately cause cardiac enlargement and progression to heart failure. Our results indicate that activation of Fas during IR may exacerbate reperfusion injury by contributing to myocyte apoptosis and altering the hypertrophic signaling pathways. Further studies are needed to determine if antagonism of Fas signaling can be used as a potential therapeutic modality to prevent acute and long-term myocardial damage following IR.

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◆ S18 (SOMA 08-20)

The Role of β -Endorphin and Enkephalin in Memory Retrieval in Cocaine Addicted Mice Using CPP Paradigm

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Background: Cocaine addiction continues to be a paramount problem in the United States, without any effective pharmacological treatments. Pre-clinical studies have clearly associated the endogenous opioid system as one of the principle modulators of the mesolimbic dopaminergic reward circuitry

and one of the possible substrates of cocaine reward and addiction. Thus, it is well established that cocaine administration causes the release of endogenous β -endorphin in the nucleus accumbens, where it induces conditioned place preference (CPP), a behavioral paradigm used to study reward. Additionally, evidence exists to implicate enkephalins which may alter the function of the mesolimbic dopaminergic circuitry and the rewarding effects of cocaine.

Hypothesis: In this study, we hypothesize β -endorphin and enkephalin plays a major role in memory retrieval in regards to drug seeking behavior in mice treated chronically with cocaine in our CPP paradigm.

Materials & Methods: In the CPP paradigm, mice (animal protocol #B06/IACUC/013) were tested for baseline preference on day 1. On day 2-9, mice received an alternate day of saline/cocaine (30 mg/kg) conditioning training and then tested for post conditioning preference on day 10. Mice were then tested again following a saline challenge on day 17 followed by a cocaine challenge on day 18. In addition we used immunohistochemistry with c-fos antibody for histological changes within the brain.

Results: Our results show that wild type mice expressed significant CPP on day 10, which was also observed on day 17. Conversely, mice lacking β -endorphin and enkephalin failed to show CPP on day 17, indicating that memory retrieval of the conditioned response was altered in mutant mice and thus we failed to reject our hypothesis. However, a cocaine challenge reinstated the CPP response in mutant mice. Furthermore there is a significant decrease in c-fos expression in nucleus accumbens and cingulate gyrus of knockout mice on day 17 compared to wildtype, which may indicate decreased activity in these brain regions.

Conclusions: The present results suggest that endogenous β -endorphin and/or enkephalin may be important in the memory retrieval of the cocaine induced-conditioned response but not in the consolidation of memory. Consequently, β -endorphin and enkephalin may be the target proteins in designing pharmacological agents to treat cocaine addiction.

Acknowledgment: The present study was supported in part by an intramural grant from Western University of Health Sciences.

S21 (SOMA 08-23)

Of Mice and Diabetic Men: Is There a Sweet Advantage of Using the Db/Db Mouse Model of Diabetes for Exercise Studies?

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◆ Indicates posters that won the 2008 Student Poster Competition.

Hypothesis: Physical activity reduces the incidence of cardiovascular diseases in diabetic patients. Benefits are largely attributed to reduction in risk factors such as obesity and hyperglycemia, and to an improvement in metabolic control. This study was designed to determine the role of exercise training on gluco-regulation as well as on important markers relating to inflammation and energy metabolism in the diabetic mouse.

Materials and Methods: Experiments were performed using the db/db mouse, a model representative of human type 2 diabetes characterized by obesity, hyperglycaemia, hyperinsulinaemia, and insulin resistance. Exercise training consisted of moderate intensity treadmill running, 5 days per week for 8-12 weeks. The lean db+/- mouse littermate served as controls. Mice were sacrificed at the end of training and blood and heart were collected for analysis. Western blot and real-time PCR analysis were used to determine protein and transcript levels of cardiac markers.

Results: Body weight of diabetic mice was significantly higher than in control mice and was not influenced by exercise training. Blood glucose, as expected, was also higher in db/db mice than in control mice and was not reduced by exercise training. Insulin levels remained increased in diabetic mice, and as a result, insulin sensitivity measured using the glucose-to-insulin ratio remained low. However, in the absence of effects on obesity and blood glucose, exercise increased the levels of cardiac endothelial nitric oxide synthase protein and lipoprotein lipase mRNA. mRNA levels for tumour necrosis factor-alpha, a pro-inflammatory marker, were reduced following exercise training in the diabetic mouse.

Conclusions: Our results show that despite no improvement in the metabolic state of diabetic mice, benefits on certain cardiac parameters are observed. Thus, this diabetic mouse model may be useful for exercise studies in the presence of persistent obesity and hyperglycaemia.

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S23 (SOMA 08-25)

Role of Lipid Rafts in the Aggregation of Alpha Synuclein in Parkinson's Disease

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Disclaimer: The protocols used were in accordance with the IRB guidelines at the Kansas City University of Medicine & Biosciences.

Parkinson's disease (PD) is the most common movement neurodegenerative disorder. The synaptic protein, alpha synuclein

(AS), is implicated in the pathogenesis of PD. AS, normally a cytosolic, monomeric protein, is present in an aggregated form in Lewy bodies, which are the pathological hallmark of PD. It has been shown that the association of AS with plasma membranes promotes this oligomerization. However, the specific microdomains in the plasma membrane that facilitate this aggregation have not been identified. The goal of the present study was to determine whether AS oligomers in PD brain are localized in the cholesterol and ganglioside-enriched lipid raft microdomains or the phospholipid-enriched non-raft domains. Human brain tissue samples from the frontal cortex, cerebellum and substantia nigra of PD patients and age-matched controls were homogenized, and lipid raft microdomains were isolated by discontinuous sucrose density gradient centrifugation. A total of 10 fractions were collected from the top to the bottom of the tubes. The various fractions were subjected to protein estimation, fluorescence-based cholesterol assay, and GM1 ganglioside analysis. The protein markers for lipid rafts, flotillin and Thy-1, were detected by Western Blot analysis. The levels and the aggregation status of AS were also detected by using this method. Our results showed a decrease in the level of total protein in the substantia nigra and cerebellum of PD brain compared to control regions. This decrease was most pronounced in the fractions corresponding to lipid rafts. We also observed a marked decrease in raft cholesterol in the substantia nigra and cerebellum of PD brain. Both of these effects were less pronounced in the frontal cortex. In addition, there was an increase in flotillin, a decrease in Thy-1, and an increase in GM1 in the substantia nigra of PD brain suggesting disease-induced changes in the composition and structure of lipid rafts. Interestingly, there was an increase in AS aggregates in the substantia nigra non-raft fractions of PD brain suggesting that the interaction of AS with these membrane microdomains facilitates oligomerization. In future studies, we would like to examine the factors that regulate AS levels and aggregation status in raft versus non-raft membranes.

Acknowledgment: This study was supported by the Summer Research Fellowship funds from the Kansas City University of Medicine and Biosciences.

S24 (SOMA 08-26)

Withdrawn

S25 (SOMA 08-27)

Protein Expression of Cytochrome P450 3A4 in Gastrointestinal Tissue Samples of HIV-Infected and Uninfected Persons

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Aims: The focus of this project was to investigate the effects

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of HIV infection on the protein expression of cytochrome P450 3A4 (CYP3A4) in intestinal samples harvested from HIV-infected persons.

Background & Hypothesis: Cytochrome P450 enzymes are involved in the metabolism of many pharmaceutical drugs, including protease inhibitors and non-nucleoside reverse transcriptase inhibitors, which are used in the treatment of the HIV infection. Previous research has indicated that intestinal tissues of HIV-infected patients are associated with down-regulation of genes linked to drug metabolism. To date, the effects of HIV on CYP3A4 protein expression and function are not well understood. The specific aim of this project is to examine CYP3A4 protein expression in small and large intestinal samples from HIV-infected and uninfected persons. Our hypothesis is that HIV infection will result in decreased CYP3A4 expression in the GI tract.

Methods: Tissue samples from the small intestine of 4 HIV-infected and 3 uninfected persons were used to study CYP3A4 protein expression via Western blot analysis. Additionally, 5 HIV-infected and 5 uninfected large intestine samples were studied. Villin, a constitutively expressed enterocyte-specific protein, was used to normalize tissue samples for enterocyte content via a 3A4/villin ratio.

Results: Both small and large intestine samples revealed higher CYP3A4 expression among HIV-infected patients when compared to uninfected patients. The patients' medication history including CYP3A4 substrates, inducers, and inhibitors were taken into consideration, because of the large number of drugs that can directly affect CYP3A4 protein concentrations.

Conclusions: HIV infection appears to result in a modest increase of CYP3A4 protein expression on epithelial cells of small and large intestinal samples when compared to uninfected samples.

Acknowledgment: This research was supported by the KCUMB Student Summer Research Fellowship Program and IRB Approval was obtained.

S26 (SOMA 08-28)

Combination Cell-Morphogen Therapy for Treatment of Degenerative Disc Disease

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Introduction: This study explores a new combination cell/morphogen method for treating intervertebral disc disease using growth factors (BMP-2, GDF-5) and mesenchymal stem cells (MSC's). The subfamily of bone morphogenic proteins (BMP's) is known for stimulating joint formation and

chondrogenesis and plays a crucial role in the developing musculoskeletal system. MSC's are capable of differentiating into cartilage-like cells capable of functioning as nucleus pulposus. We hypothesize that GDF-5, BMP-2 and MSC's delivered into the degenerative intervertebral disc space may result in a biological repair alone or combination.

Methods: 20 adult male Sprague Dawley rats were enrolled for creation of the degenerative disc (IACUC# 2007-071) previously described by Rousseau et al. A #11 scalpel was inserted 1.5 mm deep into three coccygeal disc spaces to iatrogenically injure the disc spaces. The rats were randomized to the following treatment groups: I: control II: GDF-5 III: BMP-2 IV: MSC's + GDF-5 V: MSC's + BMP-2. After three weeks, the discs were harvested, fixed in formalin, decalcified and processed for paraffin sectioning and staining. Analysis of the vertebral endplates, annulus fibrosis and nucleus pulposus was performed under light microscopy.

Results: Group I Half of the endplates were observed to have small isogenic chondrocytic pools with only 1/4 demonstrating their existence bilaterally. The nucleus pulposus was observed to be hypocellular with joint space collapse. Needle tracks were observed in the annulus fibrosis. The annulus exhibited at least one side of complete collapse. Group II Although degenerative changes existed in some of the discs, there was increased stellate cellularity of the nucleus pulposus in this group as compared to the other treatments. Group III In 4/4 rats and most discs studied, there were isogenic chondrocytic pools in the articular cartilage of both end-plates that was associated with increased thickness of the nucleus pulposus endplate. Group IV Unlike the other treatment groups, there were pools of small, basophilic cells not in communication with the endplate but separate on the lateral border of the annulus. Group V Although many of the nucleus were shrunken in this group, the endplates and annular fibers maintained integrity. Little chondrocytic pooling and no clusters of undifferentiated cells were seen.

Conclusion: This study allowed us to examine the repair process in a model of intervertebral disc degeneration. It was designed to mimic human disc injury stemming from arthritis, disc herniation, trauma and other disease processes. We were able to evaluate growth factors and stem cells alone or in combination, as biological agents of regeneration for the damaged disc. Future applications include the possible use of hydrogel and scaffolds as delivery devices for preformed disc tissue in vivo.

S28 (SOMA 08-30)

Variation of Deep Neurovascular Structures of the Hand

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The purpose of this research is to define the variations of the Deep Palmar Arch's supply to the intrinsic muscles of the hand as well as the variations of the deep ulnar nerve in its innervations. We hope to illustrate the importance of these deep structures as a safety mechanism of collateral blood flow, identify the intrinsic muscles innervated by the deep ulnar nerve, and define the vascular characteristics that may increase the likelihood of ischemia and gangrene in compression of the structures passing through Guyon's Canal. The distribution pattern of the deep ulnar nerve, its motor innervation and deep palmar arch digital contribution was studied in 66 palmar regions taken from adult Caucasian cadavers of both sexes aged over 60 y from the state of New York available in the Department of Anatomy, New York College of Osteopathic Medicine. Detailed dissections of sixty-six hands of cadavers were carried out under magnification and the results were recorded by photography and charts. In 7 of the 66 hands anastomoses were seen between the deep ulnar and median nerve. In one hand of the 66 hands a recurrent deep ulnar nerve was seen. The variants in innervations by the ulnar nerve are important considerations in diagnostic EMG testing as well as surgical reconstructive procedures and rehabilitation. This important consideration is illustrated by the 10% of the samples having an anastomosis between the median and deep ulnar nerve. Vascular variants observed by Mezzogiorno (1994) with a complete radioulnar deep palmar arch accounting for 67 to 77% of the sample size. Higher prevalence of complete deep palmar arch as observed in the present study may indicate lower risk of ischemic events due to a safety mechanism of collateral blood flow to the deep structures of the hand.

Acknowledgment: Research was sponsored by the New York College of Osteopathic Medicine.

S30 (SOMA 08-35)

The Hyperphagic Effect of Orphanin FQ on Hypothalamic Neurons

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Purpose of Study: The specific aim of the research is to show that Orphanin FQ (OFQ) OFQ stimulation of feeding is due to pre- and postsynaptic effects on proopiomelanocortin (POMC) neurons, which are a critical anorectic component of the hypothalamic feeding circuitry.

Methods Used: Feeding studies were conducted over the course of 5-6 days in ORL1 receptor knockout (KO) mice and their wildtype (WT) littermate controls that were fasted 18 hr prior to initiating the six-hr observation window. We also performed whole-cell patch clamp recordings in hypothalamic slices from ORL1 KO mice and their corresponding WT littermates.

Summary of Results: We found that ORL1 KO mice exhib-

ited a comparatively blunted hyperphagic response; consuming less food over the first three hrs of the observation window. Meal consumption occurred at a higher frequency, but the meals were of shorter duration and less food was eaten per meal as compared to the WT littermates. In addition, the average daily weight of the ORL1 KO animals was significantly less than their WT littermates. Whole-cell patch clamp recordings of arcuate neurons obtained from WT controls, revealed that OFQ (1 μ M) induced a decrease in the frequency but not amplitude of miniature excitatory postsynaptic currents that were antagonized by the ionotropic glutamate receptor antagonists NBQX (3 μ M) and CGS 19755 (10 μ M). OFQ also elicited a reversible outward current that reversed polarity near the Nernst equilibrium potential for K⁺, exhibited increased conductance at membrane potentials more hyperpolarized than the reversal potential, and was attenuated by the G protein-gated inwardly-rectifying K⁺ (GIRK) channel blocker tertiapin (10nM). Cells showing these responses expressed both the posttranslational POMC byproduct α -melanocyte stimulating hormone and the GIRK1 channel subtype. By contrast, arcuate neurons from ORL1 receptor KO animals did not express the ORL1 receptor, and as a result the actions of OFQ were negated.

Conclusions: These findings indicate that the Hyperphagic effect of OFQ is ORL1 receptor-mediated and due, at least in part, to a combination of presynaptic inhibition of glutamate synaptic input onto anorexigenic POMC neurons, and the postsynaptic activation of GIRK1 channels in these cells.

S36 (SOMA 08-43)

The α_1 Adrenergic Vascular Response Differs in a High and Low Weight Experimental Line of Chickens: Development of a Non-Mammalian Gender Differentiating Animal Model of Human Hypertension in Obesity

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Introduction: Systemic blood pressure is a function of cardiac power, circulating volume and vascular tonus. Vascular tonus is regulated by a variety of factors involving peptides (for example, renin-angiotensin), steroids (for example, aldosterone, estrogen, testosterone) and catecholamines (for example α and β adrenergics). The current study specifically addresses if, in a non-mammalian model, gender and body mass alter α_1 adrenergic vasomotor activity before and following inhibition of nitric oxide synthase.

Materials & Methods: A total of 16, age matched, chickens were used; 8 obese; 4 high weight females (HWF), 4 high weight males (HWM), 8 lean; 4 low weight females (LWF) and

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4 low weight males (LWM). α_1 adrenergic vasomotor activity was determined by serial phenylephrine addition to isolated aortas perfused in 37°C oxygenated Krebs-Henseleit before and after addition of a nitric oxide synthase inhibitor, g-nitro-L-Arginine-Methyl Ester (LNAME).

Results: Efficacy, determined by maximum tension (T_{max}), developed from prior to following nitric oxide synthase inhibition with LNAME was different only in LWF ($p < 0.007$). While potency, calculated as 50% of the agonist concentration required to reach maximum contraction (EC_{50}), prior to and following LNAME approached significance in HWF ($p < 0.06$), no significant changes in either T_{max} or EC_{50} were noted in any other group. A significant difference was noted in α_1 adrenergic potency between LWF and LWM ($p < 0.03$) prior to LNAME while HWM and HWF showed a tendency ($p < 0.07$) in α_1 adrenergic potency prior to LNAME while HWF show a significantly lower EC_{50} with α_1 adrenergic stimulation compared to LWF ($p < 0.007$). Following nitric oxide synthase inhibition with LNAME, LWF showed significantly greater T_{max} compared to LWM ($p < 0.02$). T_{max} was also different ($p < 0.05$) when LWF and HWF were compared.

Conclusions: The current study shows that in these obese and lean chickens: 1. Nitric oxide (NO) significantly modulates T_{max} only in LWF, 2. LWF are more sensitive than LWM to α_1 adrenergic agonism, and 3. LWF are more sensitive to α_1 adrenergic stimulation than either HWM or HWF. These initial findings indicate that the effects of obesity and gender differ with respect to α_1 adrenergic vasomotor activity and that nitric oxide synthase activity is a significant effector of blood pressure, sensitive to both gender and body mass in this model.

S37 (SOMA 08-44)

Analysis of N-cadherin Invasion Mechanisms in Oral Tumor Cells

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Background: The survival rate of oral cancer patients substantially decreases once oral tumors become invasive. Cadherins are a family of cell adhesion molecules that play a role in the invasiveness of oral tumors. The overexpression of N-cadherin in oral tumor cells leads to increased invasiveness and the downregulation of expression of E-cadherin, an epithelial cadherin that has tumor suppressive properties. It is not known whether E-cadherin loss is necessary for the action of N-cadherin in promoting invasion.

Hypothesis: We hypothesize that N-cadherin confers invasiveness via a mechanism that is independent of E-cadherin downregulation.

Methods: To distinguish between the effects of N-cadherin overexpression and E-cadherin loss, oral squamous carci-

noma cells were retrovirally transduced to express either high levels of N-cadherin or reduced levels of E-cadherin. These cells were analyzed with respect to their motility, growth, and invasive capabilities. The invasiveness of these cells was measured by zymographic analysis to determine the amount of the invasion-associated protease matrix metalloproteinase 9 (MMP-9). Transcript levels of MMP-9 mRNA from control and N-cadherin overexpressing cells were also analyzed by Real Time Polymerase Chain Reaction (RT-PCR). Finally, because N-cadherin can bind beta-catenin, a protein which can also function as a transcription factor, a series of luciferase reporter assays were conducted to specifically measure beta-catenin dependent transcriptional activation.

Results: Reduced expression of E-cadherin decreased motility compared to N-cadherin overexpressing cells and control cells but did not affect cell growth rate. N-cadherin overexpression, but not E-cadherin depletion, increased both MMP-9 protein and RNA levels as measured by zymography and RT-PCR respectively. Cells that overexpressed N-cadherin showed a seventeen-fold increase in the amount of beta-catenin-mediated transcriptional activation compared to controls.

Conclusions: These results suggest that the invasiveness of N-cadherin-overexpressing cells is independent of E-cadherin downregulation. They also suggest that beta-catenin may play a role in the N-cadherin-initiated signaling.

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S42 (SOMA 08-49)

Ovariectomy and Castration Decrease Renal Protein Excretion in Mice

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Females are protected against various renal diseases until menopause. To identify the cause for this renoprotection, investigators have focused more on estrogen-mediated mechanisms rather than androgen-related events. The purpose of this study was to determine the effects of ovariectomy and castration on the renal excretion of protein in mice. We hypothesized that removing endogenous sex hormones via ovariectomy and castration would increase protein excretion in the female and decrease it in the male. Two studies were conducted: one with males, 6 normal (NM) and 6 castrated (CM) and one with females, 6 normal (NF) and 6 ovariectomized (OF). Mice, four-weeks old, were placed in metabolic cages and consumed *ad libitum* a high-protein (40% casein) diet for 25 days. The key findings showed that protein excretion at day 25 in NF exceeded that in OF and protein excretion in NM exceeded that in CM. Protein excretion (mg/day) data for

females: (Day 2: NF=3.8±0.7 vs OF=2.5±1.0 NS); (Day 25: NF=8.3±0.9 vs OF=5.6±0.9; p<0.02). Protein excretion data for males: (Day 2: NM=5.5±0.8 vs CM=4.2±0.7 NS); (Day 25: NM=31.0±0.8 vs CM=5.9±0.9 p<0.001). Moreover, ovariectomy and castration significantly reduced kidney weight-to-body (KW/BW) ratio compared to respective normal groups with the largest difference observed in the males. (KW/BW ratio on day 25 for females: NF=.0140±.001 vs OF=.0126±.0003, p<.01; and for males, NM=.0163±.0010 vs CM=.0120±.0004* p<.003). ANOVA of these data yielded no difference between the OF and CM. We conclude that sex hormones clearly affect renal excretion of protein and play significant roles in kidney growth and development. Surprisingly, ovariectomy reduced protein excretion in females whereas castration completely prevented any increase in protein excretion from the high-protein diet in males. These results suggest that the androgen-mediated mechanism requires extensive study in understanding the gender differences associated with renal physiology and will likely lead to more effective therapeutic approaches in clinical treatment of kidney disease. Studies are underway to measure expression of androgen and estrogen receptors in the kidneys from these mice.

◆ S10 (SOMA 08-11)

Quality and Availability of Websites for AOA Residency Programs in Comparison to ACGME Programs

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Background: Matching to residency is one of the most anticipated events for senior medical students. D.O. students use the Electronic Residency Application Service (ERAS) for residency applications. The students have the choice of using the National Matching Service (NMS) and/or the National Resident Match Program (NRMP) to match into a residency program. With the application process entirely online, one cannot underestimate the importance of clear, reliable websites as a tool for applicants and programs to share information.

Hypothesis: In 2008, 90.6% of Accreditation Council for Graduate Medical Education (ACGME) Family Medicine positions filled compared to 44.0% of American Osteopathic Association (AOA) positions.^{1,2} Match statistics demonstrate quantitative program comparisons, but few efforts have been made to address electronic marketing success of programs or the quality of information available to applicants. The purpose of this study is to evaluate differences in the information available on websites provided by ACGME and AOA programs, compare common features, and assess the ability to easily connect to these sites from national residency databases. Our hypothesis is that AOA program websites are inferior in content quality and accessibility from ACGME programs.

Methods: 50 AOA and 50 ACGME Family Medicine resi-

dency programs were randomly selected, with dually-accredited programs removed from the former to ensure simple random sampling. Program websites were then evaluated using 18 objective criteria for site accessibility and quality of information.

Results: An analysis found statistically significant differences in each of the 18 criteria (p≤.03 by Fisher's Exact Test). 48 of the 50 (96%) ACGME programs had a website dedicated to Family Practice compared to 31 of the 50 (62%) AOA programs (p<.001). 28 of 50 (56%) ACGME programs had a link from ERAS directly to the family practice website compared to 4 of 50 (8%) AOA programs (p<.001). 47 of 50 (94%) ACGME programs listed the names of the faculty compared to 21 of the 50 (42%) AOA programs (p<.001).

Conclusions: The results demonstrate several deficiencies in the websites of AOA Family Medicine programs compared to ACGME programs. They provide a valuable insight into match statistics and are useful for improving future residency application processes.

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Medical Education and Health Policy

S17 (SOMA 08-18)

Performing Preclerkship Pelvic Examinations Improves Student Perceptions of Clerkship Preparedness

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Purpose: We tested the hypothesis that practice pelvic examinations on standardized patients within the second year osteopathic medical school curriculum improves students' perceptions of competency and preparedness for clinical rotations.

Methods: After IRB approval, 260 second year medical students at Kansas City University of Medicine and Biosciences—College of Osteopathic Medicine (KCUMB-COM) were asked, both verbally and via e-mail, to complete two electronic surveys. The pre/posttest surveys were voluntary and anonymous, and included questions about demographics and pelvic exam experience. The pre-test survey consisted of 18 questions and the post-test contained 41 questions.

Results: Of the 260 students solicited, 88 (34%) completed

◆ Indicates posters that won the 2008 Student Poster Competition.

STUDENT CONTRIBUTIONS

the pre-test survey (36 male, 51 female), and 71 (27%) completed the post-test survey (32 male, 34 female). In the pre-test, 76 students (90%) indicated they never had performed a pelvic exam. Before the activity, 39 (45%) students did not know how to use a speculum; 57 (67%) could not bi-manually locate the cervix; 69 (81%) could not bi-manually locate the uterus; 72 (85%) could not bi-manually locate the ovaries; 74 (87%) could not assess pubococcygeus muscle tone; and 31 (36%) students were not familiar with the appearance of a cervix. Following the experience, 71 (100%) students knew how to use a speculum; 70 (99%) could bimanually locate the cervix; 66 (93%) could bimanually locate the uterus; 57 (80%) could bi-manually locate the ovaries; 44 (62%) could assess pubococcygeus muscle tone; and 70 (99%) students knew what a cervix looked like. Students indicated that the practice pelvic exam improved their perception of preparedness (n=70, 99%) and confidence (n=64, 90%) for performing the pelvic exam in a clinical situation. In addition, 64 (90%) students reported that the experience helped reduce their anxiety about performing pelvic exams.

Conclusions: The practice pelvic exam activity at KCUMB-COM provides second year students with an effective learning environment to ask questions, develop skills, receive feedback, and improve confidence during potentially uncomfortable clinical situations. The practice pelvic exam considerably improved students' self-perceived competency and preparedness for clinical rotations, which may help their performance. The utility of this experience during the third and fourth years of medical education warrants further investigation.

◆ S31 (SOMA 08-36)

An Analysis of the Use of Web-Based Materials by Medical Students and its Relationship to Learning Style

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The purpose of this study was to analyze the use of student-generated web-based materials presented via a course management system by first-year medical students at the Philadelphia College of Osteopathic Medicine during the Cell and Tissue course. The study also analyzed the learning styles of the participants, as defined by the Index of Learning Style construct, to determine if a correlation existed between learning style, use of online study materials and course performance. The study quantified the use of web-based materials by students utilizing the tracking function on the course management site and administering an anonymous survey to the participants. The surveys gathered information on the par-

ticipants' self-assessed learning style, according to the Index of Learning Style construct, their use of the online study materials, the material's usefulness for examination preparation and projected course grade. Institutional Review Board, IRB, approval was given to obtain web-based tracking and survey information from the participants without the necessity of informed consent. Our results showed that a majority of medical students in a first-year course at an Osteopathic Medical school accessed Blackboard®, an online course management system throughout the course duration. Half of those medical students used the online study guides that were provided to them via the course management system for use in their course examination preparation. However, there was no correlation between the use of the online study materials and final course grade. The survey results showed a distribution of learning styles among the participants as follows: equal numbers of active and reflective learners and a greater percentage of sensing and visual learners over intuitive and verbal learners, respectively. Among the participants who used the online study guides available to them we found a greater percentage of active, intuitive, and visual learners over their domain counterparts, reflective, sensing, and verbal learners, respectively. The study also found those students who identify themselves as reflective and sensing learners, as described by the Index of Learning Style construct, appear to achieve higher course grades than the active and intuitive learning styles, respectively. Thus this study has shown that there is a distinct distribution of learning styles within our cohort of first-year medical students. Of these, there is a subset of learning styles that appear to have a strong preference for web-based educational modalities. This information can be used to direct medical students towards study materials that would best appeal to their learning style. Results of this research also suggest a continued role of web-based learning modalities and course management systems as an adjunct to traditional methods, such as a professor-lead lectures and textbook readings, in medical education.

◆ Indicates posters that won the 2008 Student Poster Competition.