

# 2010 Appalachian Student Research Forum

April 8, 2010

*coordinated by*

The Office of Research  
and Sponsored Programs

East Tennessee State University

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Centre at Millennium Park • Johnson City, TN



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# Schedule of Events

April 7 – 8, 2010  
The Centre at Millennium Park • Johnson City, TN

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## **Wednesday, April 7, 2010**

1:00 pm – 4:30 pm	Check-in and Poster Set-Up	Ballroom
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## **Thursday, April 8, 2010**

8:00 am – 12:00 pm	Poster Judging	Ballroom
8:00 am – 4:00 pm	Poster Viewing	Ballroom
8:00 am – 12:00 pm	Vendor Exhibition	2 <sup>nd</sup> floor
9:00 am – 12:00 pm	Oral Presentations: Graduate Students, Group A Graduate Students, Group B Residents & Post-Doctoral Fellows	Room 130 Room 120 Auditorium
12:00 – 1:30 pm	BUFFET LUNCH	2 <sup>nd</sup> floor
1:30 – 2:30 pm	Keynote Address	Auditorium

### ***“Earth, Wind and Fire: the Struggle of the World's Poor”***

#### **William J. Martin II, M.D.**

Associate Director, National Institute for Environmental Health Sciences  
and Director, Office of Translational Research, National Institutes of Health

2:30 – 3:00 pm	Awards Ceremony	Auditorium
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*\*\* Posters should be removed by 4:30 pm\*\**

# Keynote Presentation

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## *“Earth, Wind and Fire: the Struggle of the World's Poor”*

**William J. Martin II, M.D.**



Associate Director,  
National Institute for  
Environmental Health Sciences

Director,  
Office of Translational Research  
National Institutes of Health

William J. Martin II, M.D. joined the National Institute of Environmental Health Sciences as Associate Director, NIEHS and Director, Office of Translational Research, in March 2006 with a special interest in developing new approaches in the application of research discoveries to benefit vulnerable populations in the developing world.

Dr. Martin received his M.D. from the University of Minnesota in 1974, and completed his pulmonary and critical care training at Mayo Clinic in 1979. Following completion of his research training in the Pulmonary Branch at the National Heart, Lung and Blood Institute, he joined the staff of Mayo Clinic as a clinician-investigator in 1981. While on faculty at Indiana University, Dr. Martin served as a Health Policy Fellow, United States Senate, Labor and Human Resources Committee in 1995-1996.

He also served as the Director of Pulmonary and Critical Care at Indiana University for twelve years before becoming the Executive Associate Dean for Clinical Affairs at the University's School of Medicine. Dr. Martin recently served as the Dean of the University of Cincinnati College of Medicine and is a past president of the American Thoracic Society. He served as a volunteer physician for Project Hope on the US Navy hospital ship, the USNS Comfort, following Hurricane Katrina in Sept/ 2005.

As a clinician investigator, he has authored more than 130 research and clinical papers, and has been an NIH-funded scientist for the past 24 years. Dr. Martin has been an invited speaker for nearly 200 events, including testifying before the World Health Organization and U.S. Congress.

Dr. Martin is focused on improving the health of people in the developing world by reducing exposure of particularly women and children to indoor smoke from burning of biomass fuels, a condition which affects 2.5 billion people on the planet. In this capacity, Dr. Martin serves as the NIH representative on the CDC Indo-US Joint Working Group and the EPA Partnership for Clean Indoor Air.

# ASRF Task Force

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**Dr. Dhirendra Kumar, Chair**  
Biological Sciences

**Dr. Russ Brown**  
Psychology

**Dr. Ranjan Chakraborty**  
Health Sciences

**Dr. Scott Champney**  
Biochemistry & Molecular Biology

**Dr. William Duncan**  
Vice Provost for Research

**Dr. Wayne Gillespie**  
School of Graduate Studies

**Dr. Lee Glenn**  
Professional Roles/Mental Health Nursing

**Dr. Gary Henson**  
Physics, Astronomy & Geology

**Dr. Foster Levy**  
Undergraduate Research/  
Biological Sciences

**Dr. Louise Nuttle**  
Research and Sponsored Programs

**Dr. Mike Ramsey**  
Kinesiology, Leisure& Sport Sciences

**Dr. Mitch Robinson**  
Biomedical Graduate Program

**Ms. Barbara Sucher**  
Continuing Medical Education

**Ms. Carole Thomason**  
Research and Sponsored Programs

**Dr. Michael Whitelaw**  
Geosciences

# Judges

## Poster Presentations

### Division I – Undergraduates

#### Arts & Humanities and Biomedical Sciences

Yu-Lin Jiang

Bert Lampson

#### Natural Sciences and Mathematics

Scott Champney

David Johnson

Phillip Musich

Douglas Thewke

#### Social and Behavioral Sciences

Gary Henson

Thomas Jones

Brajesh Dubey

Lev Yampolsky

### Division II – Graduate Students 1-2 Yrs

#### Arts & Humanities and Biomedical Sciences

Ahmad Zulfiqar

Yuri Raiskazovskiy

#### Natural Sciences and Math

Ismail Kady

Tim McDowell

#### Behavioral and Social Sciences

Thomas Laughlin

Tricia Metts

### Division III – Grad Students – 2+ Yrs.

#### Biomedical Sciences, Natural Sciences & Mathematics, and Social & Behavioral Sciences

Jim Stewart

Alisha Bray

### Division IV and VI – Medical Students and Case Histories

Sharon Campbell

Rob Wondergem

### Division V – Med. Residents and Post-Docs

Mitch Robinson

Antonio Rusinol

## Oral Presentations

### Residents and Post-Doctoral Fellows

Sadie Hutson

David Linville

Tiejan Wu

### Graduate Students

Beth Bailey                    David Currie

Karl Joplin                    Jodi Polaha

Bea Owens                    Joy Wachs

# Forum Sponsors

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Philip D. Cooper Memorial Research Trust Fund, Inc.

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## East Tennessee State University

The Office of Research & Sponsored Pgms

The School of Graduate Studies

The Ronald E. McNair Post Baccalaureate  
Achievement Program

The Center for Early Childhood Learning  
and Development

The Office of the Vice President for Health  
Affairs

The College of Arts & Sciences  
Office of the Dean  
Department of Chemistry  
Department of English  
Department of Mathematics  
Department of Physics and Astronomy  
Department of Psychology

The College of Business & Technology  
Office of the Dean  
Bureau of Business and Economic  
Research

The Clemmer College of Education  
Department of Curriculum &  
Instruction

The College of Clinical & Rehabilitative  
Health Sciences  
Office of the Dean  
Allied Health Sciences  
Communicative Disorders

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Office of the Dean  
Department of Anatomy & Cell  
Biology  
Department of Biochemistry &  
Molecular Biology  
Department of Geriatrics  
Department of Microbiology  
Department of Obstetrics/Gynecology  
Department of Pediatrics  
Department of Pharmacology  
Department of Physiology  
Department of Psychiatry & Behavioral  
Sciences  
Department of Surgery

The College of Nursing  
Center for Nursing Research

The College of Public Health  
Office of the Dean  
Department of Environmental Health  
Department of Health Sciences

# Special Thanks

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The 2009 Student Research Forum Task Force  
would like to recognize and thank

*The East Tennessee State University  
Center for Community Outreach and Family Services*

for their generous support of this year's Student Research Forum,  
without which this event would not have been possible.



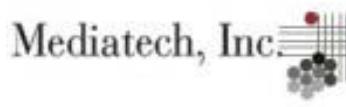
## Student Artwork on Display in the Atrium

<i>Artist</i>	<i>Title</i>	<i>Advisor</i>
Jake Ingram	"Ascending Ibex"	Anita DeAngelis
Amber Moore	"Self Portrait"	
Samantha Leaver	"Frequency"	Pat Mink
James Lunsford	"On Technology"	Mike Smith
Evan Townsend	"Yosemite Images"	Catherine Murray
Brittany Willis	"The Marx"	Anita DeAngelis
Taylor Norris	"Brothers"	Joanna Cyrier

Student Art Coordinator: Stephanie Streeter

# Exhibitors

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# Poster Presentation Abstracts

## Division I – Undergraduates

### Arts & Humanities and Biomedical Sciences

#### **RETENTION OF CARDIOPULMONARY RESUSCITATION SKILLS AND KNOWLEDGE AMONG REGISTERED NURSES**

Tanya Cox and Kimberly Sell, Department of Adult Nursing, College of Nursing, East Tennessee State University, Johnson City, TN

The American Heart Association formally endorses that all healthcare workers including registered nurses (RN's) renew their cardiopulmonary resuscitation (CPR) skills and knowledge every 2 years. Today, with cardiac arrest being the leading cause of death in the United States and accounting for 325,000 deaths each year, CPR is an ever-important lifesaver. For hospitalized patients, RN's are generally the first responders to cardiac arrests and need to be prepared for these instances. Nurses must be proficient in their CPR skills to act accordingly during emergent situations. However, past research has shown that as soon as two weeks post CPR certification, RN's experience a decline in their CPR knowledge and skills. Therefore, my research aims at evaluating the ability of registered nurses to remain competent in CPR, the factors that might influence CPR retention, the rate of CPR knowledge and skill decay, and the need for regular updating in CPR. Questionnaires with a cover letter were left at the nurse's station and consenting RN's completed the questionnaire on a voluntary basis. The questionnaire asked RN's various demographics like: age, number of years employed as a RN, number of times CPR used, and etc. The questionnaire also asked ten knowledge-based questions to evaluate retention level. The questionnaires were collected after 2 weeks with no further participant contact. The analysis revealed that months since last CPR certification and the knowledge and skill test score are correlated and statistically significant. The results portrayed that as the months since the last CPR certification increases for a RN, the test score decreases. This result confirmed the hypothesis that CPR retention declines over time. All in all, various factors do influence the ability of RN's to retain their CPR knowledge and skills, such as months since last CPR certification. The findings suggest that taking a refresher course every two years is not sufficient; there is a need for more frequent updating in CPR.

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#### **THE EFFECT OF DRUGS AND ALCOHOL ON AUTOPSY CASES PERFORMED AT THE WILLIAM L. JENKINS FORENSIC CENTER FROM 2003-2009.**

Caleb Harrell<sup>1</sup>, William McCormick<sup>2</sup>, Gretel Stephens<sup>2</sup>, Teresa Campbell<sup>2</sup>, Paul Benson<sup>2</sup>, Karen Cline-Parhamovich<sup>2</sup>, Emily Lemieux<sup>1</sup>, and Kenneth Ferslew<sup>1</sup>, <sup>1</sup>Toxicology and <sup>2</sup>Forensic Pathology, William L. Jenkins Forensic Center, East Tennessee State University, Johnson City, TN

The William L. Jenkins Forensic Center has performed autopsies on the questionable and medicolegal deaths which occurred in the eight counties of the First Tennessee Development District from 2003 through 2009. The purpose of our research was to compile descriptive statistics on the impact of alcohol and/or drugs, and determine whether any trends exist in the autopsies performed from 2003 through 2009. Toxicological evaluations of specimens collected at autopsy were used to determine if drugs and/or alcohol were involved in the deaths. A descriptive database was established defining all parameters and data pertinent in each case (age, sex, cause/manner of death, and toxicological results). Specimens (blood, gastric contents, urine, and vitreous humor) from the autopsies were

analyzed for drugs and alcohol using multiple analytical toxicological procedures including: colorimetric, thin layer chromatography (TLC), immunochemistry, gas chromatography (GC), gas chromatography mass spectroscopy (GCMS), and liquid chromatography mass spectroscopy (LCMS). Toxicological results were compiled in an electronic database (Microsoft Access) to allow for analysis and interpretation. Case number per year ranged from a minimum of 226 (2004) to a maximum of 306 (2009) with a general increase in the number of cases per year over the period. Results indicate that the impact of alcohol and drugs as a percentage of cases ranged as follows: positive for drugs from 76% (2009) to 87% (2003), positive for drugs and alcohol from 59% (2005) to 70% (2003), and positive for alcohol alone from 22% (2009) to 36% (2004). Acute drug overdose was the cause of death in 22% (2009) to 35% (2007) of cases per year. While the percentages of cases with drugs, drugs and alcohol, and alcohol alone varied from year to year, the proportionality of these groups to one another remained relatively constant over the years analyzed. In the range of years studied, drugs appeared in a greater percentage of cases than drugs and alcohol, which appeared in a greater percentage of cases than alcohol alone. The most prevalent groups of drugs present at autopsy, other than alcohol, were opiates and benzodiazepines. These drugs were present in ranges from 14% (2005) to 26% (2007). Other major drugs, or classes of drugs present (as a percentage of case per year) were: cocaine from 6% (2009) to 15% (2005), methadone from 6% (2003 and 2009) to 12% (2006 and 2007), stimulants from 7% (2003 and 2009) to 16% (2005 and 2006), and sedatives from 5% (2004) to 12% (2003 and 2006). There was an increased prevalence of opiates and benzodiazepines in our forensic cases from 2005 through 2009, as well as an increase in the number of autopsy cases in which these drugs were found in combination. This increase may reflect the amplified clinical use of these drugs in our region, misuse of prescription drugs, or increased diversion of prescription medications.

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#### **AGING PREMATURELY? COULD IT BE RELATED TO THE EFFICIENCY OF REPAIRING DAMAGED DNA?**

McKayla Johnson, Yue Zou and Phillip R. Musich, Department of Biochemistry and Molecular Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Hutchinson-Gilford Progeroid Syndrome (HGPS) cells inefficiently convert prelamin-A to lamin A, producing an abnormal progerin protein. Accumulation of progerin causes abnormal chromatin and premature aging as well as an accumulation of DNA damage that is inefficiently repaired. HGPS also serves as a model for human aging. Because the relative sensitivity of HGPS cells to ultraviolet radiation, a typical DNA damage agent, is unknown, the rate of DNA repair was compared between HGPS and normal BJ cells after UV radiation using cytotoxicity assays. It was hypothesized that these aging HGPS cells would have a decreased ability to repair DNA damage and, thus, be arrested in the cell cycle relative to normal fibroblast cells. Testable aspects of this hypothesis were to monitor the DNA repair efficiency of BJ cells versus that of HGPS after acquiring UV-induced DNA damage, and since it was expected that HGPS cells would display a greater sensitivity to UV, their overall viability and growth rate would be monitored. Another testable aspect was to examine whether as aging increases, the ability to repair accumulated DNA damage decreases. Experimentally, HGPS and BJ cells were cultured in a 96-well microtiter plate for 24 hours before the UV-B or UV-C exposure. After being exposed, the cells were allowed a 72-hour recovery period. A fluorometric cell viability assay (Cell-Titer Blue Viability Assay, Promega) was performed to determine the total number of metabolically active cells in each well. Then the cells were lysed using formamide and a protease K digestion to allow Sybr Green staining of released cellular DNA, also measured by fluorescence. The DNA amount directly corresponds to the number of attached viable cells per well, indicating cell multiplication rather than metabolic activity. These data were plotted for both the UV-C and UV-B exposures. In the current preliminary studies, no detectable difference in viability has been observed between HGPS and normal BJ cell lines. This suggests that the HGPS may have a repair efficiency similar of the BJ cells. In future studies, a comparison between BJ and differently-passaged HGPS cells will determine if the passaging affects the efficiency of DNA repair after UV damage. Understanding the role and mechanism of DNA repair can advance our knowledge of the premature aging and common ageing processes, and the relationship to DNA damage and repair.

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## **HUMAN NEUTROPHIL ELASTASE EXPRESSION IN *Kluyveromyces lactis***

Haley Klimecki, Eliot Smith, and Dr. David Johnson, Department of Biochemistry and Molecular Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Human neutrophils are the most abundant type of white blood cell and provide the body with a line of defense against foreign, infectious microorganisms. Contained within the azurophilic granules in the cytoplasm of neutrophils are three serine proteases: Human Neutrophil Elastase (HNE), Cathepsin G, and Protease 3. Once white blood cells engulf foreign bacteria, these enzymes attack the invading organism thus aiding in the killing process; however, genetic mutations in HNE or failure to properly regulate its activity can compromise a person's immunity. Neutropenia is one such disease caused by a genetic mutation of HNE that results in susceptibility to infection. HNE is also a powerful enzyme that can attack the elastin of the lung if not properly held in check by the body's own inhibitors; consequently, genetic deficiencies of alpha-1 proteinase inhibitor in the blood result in emphysema when active HNE is released from neutrophils and is free to degrade lung tissue. Recombinant HNE is not currently available and the enzyme must be isolated from human blood, which has inherent hazards. The lack of recombinant HNE has prevented studies using site-directed mutagenesis to study the intracellular processing of HNE near its C-terminal end where mutations have been found to result in neutropenia. Thus, expression of active recombinant HNE is the primary objective of this project. The pKLAC1 vector, used for the transformation of *Kluyveromyces lactis* (K. lactis) via homologous recombination into the yeast's genome, was modified to create a new vector, pK?R, using a commercially synthesized, codon optimized gene encoding a fusion protein of alpha mating factor joined with rubredoxin and six histidines (? mating factor-Kex2-Rub-6His) with an intervening Kex2 protease that removes the alpha mating factor from its fusion partners. The protein is directed for secretion via fusion with the alpha mating factor and rubredoxin serves as an expression marker allowing visualization of K. lactis producing positive transformants. The vector is designed to integrate under the control of the LAC4 gene promoter that regulates ?-galactosidase gene transcription. This vector also contains the Aspergillus nidulans acetamidase gene (amdS) that enables selection of yeast containing the fully constructed insert by allowing their growth on nitrogen-free minimal medium containing acetamide. Codon optimized DNA encoding HNE with an N-terminal enterokinase cleavage site, D4K, was cloned into pK?R after Rub-6His and this linearized vector (pKaR-HNE) was then used to transform the GG799 strain of K. lactis. The expectation is that upon induction with galactose, transformed K. lactis cells will secrete a red fusion protein of Rub-6His-D4K-HNE. This fusion protein will be purified by binding to a Ni column and eluted with imidazole buffer. The purified protein will be treated with enterokinase to release active HNE. Supported by National Heart, Lung and Blood Institute grant 1R15HL091770.

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## **CHARACTERIZATION OF DNA DAMAGE REPAIR IN PROGERIA (PREMATURE AGING) CELLS**

Nahid Mehraban, Yue Zou and Phillip Musich, Department of Biochemistry and Molecular Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

In response to DNA damage, eukaryotic cells are arrested during cell cycling to allow time for repair of the damage. Accumulation of endogenous DNA damage occurs in normal human cells, but at a faster rate in progeria cells, especially in Hutchinson-Gilford Progeria Syndrome (HGPS) cells. We hypothesize that progeria cells repair DNA less efficiently than normal cells, and that the repair efficiency decreases further in older progeria cells. This was tested by using ultraviolet radiation (UV-C) to damage normal and progeria cells, and monitoring the rate of Nucleotide Excision Repair (NER) of the base adducts formed in the DNA. We compared repair in HGPS cells of different passages with the repair in normal fibroblast (BJ) cells. A novel ELISA technique was developed to measure Cyclobutane Pyrimidine Dimer (CPD) and pyrimidine (6-4) PhotoProduct [(6-4)PP] lesions. HGPS fibroblasts and normal BJ fibroblasts were cultivated and exposed with UV-C light (20 & 30 J/m<sup>2</sup>) to induce UV damage before returning them to the incubator to allow time for repair of the DNA damage. After specific recovery intervals cells were harvested and the cellular DNA was purified. After heat denaturation the DNA was bound to the surface of wells in a 96-well microtiter plate for detection of CPDs and (6-4)PPs by an ELISA method using

antibodies specific for each of these base modifications. For repair of (6-4)PP, no significant differences were observed between the BJ or HGPS cells exposed to either 20 or 30 J/m<sup>2</sup> of UV-C. However, for each cell type the rate of (6-4)PP repair was faster for cells exposed to 20 J/m<sup>2</sup> than 30 J/m<sup>2</sup>. For CPD, no repair was observed at 30 J/m<sup>2</sup> in BJ or HGPS cells. However, at 20 J/m<sup>2</sup> the BJ repaired 25% of the damage after 30 hours while no significant repair occurred in the HGPS cells. These data further support the notion that there are differences in the mechanisms of NER for CPD vs. (6-4)PP base adducts. In conclusion, regardless of age (6-4)PPs were repaired in the progeria cells as well as the BJ cells. In contrast, the rate of CPD repair in BJ was faster than HGPS cells though this depends on the extent of damage. The differences observed in CPD and (6-4)PPs repair encourage us to investigate the NER process in the prematurely aging HGPS cells further as a tool to define the mechanistic differences between CPD vs. (6-4)PPs repair.

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#### **ACIDIC MUCOSAL pH DECREASES *CHLAMYDIA TRACHOMATIS* SEROVAR E ATTACHMENT AND ENTRY IN HEC-1B CELLS IN VITRO.**

D.A. Phillips, C.G. Moore, M.G. Schell, J.D. Whittimore, P.B. Wyrick

Department of Microbiology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

*Chlamydia trachomatis* is the leading cause of bacterial sexually transmitted infections in the USA and worldwide, with 4 million and 90 million cases per year, respectively. Under normal physiological conditions, the vaginal vault maintains an acidic pH (~4.0) with the aid of peroxide-producing *Lactobacilli*, functioning as a protective barrier that inhibits infection by certain pathogenic microorganisms (Hawes *et al*, 1998). It is hypothesized that sexually transmitted bacteria like *Chlamydia trachomatis* are inhibited by the naturally acidic vaginal pH (Zeitlin *et al*, 2002). However, hormonal fluctuations and instability, whether by use of oral contraceptives or time since menarche, result in a higher, more neutral vaginal pH (Brabin *et al*, 2005). Further, hormonal contraceptives also promote cervical ectopy, where columnar epithelial cells migrate from the endocervix onto the ectocervical mouth of the uterus, exposing the epithelial cells to the conditions in the vaginal environment and making them susceptible to infection; the latter facilitates cervical infection via chlamydial migration into the endocervix (Critchlow *et al*, 1995; Morrison *et al*, 2004). Das *et al* found chlamydial infections are associated with higher (more neutral) vaginal pH independent of other factors (Das *et al*, 2005), but the topic is highly controversial. An *in vitro* analysis of the effects of pH on *C. trachomatis* inclusion formation in fibroblast cells (McCoy) yielded a 3-10 fold decrease in infectivity at pH 4.5 than at pH 7.5 for serovar E (Yasin *et al*, 2001). In this study, we examined *in vitro* the infectivity of *C. trachomatis* elementary bodies (EBs) incubated in a range of physiologically relevant pHs (4.0-7.4) for various times and temperatures, and analyzed the effect such conditions have on *C. trachomatis* inclusion development in their natural host cell -- human genital epithelial cells (HEC-1B). Immunofluorescence assays illustrated a 3-7 fold decrease in chlamydial infectivity at pH 4.0 when compared to pH 7.4, suggesting the naturally acidic pH of vaginal mucosa does act as a preventative barrier against *C. trachomatis* infection. Conversely, an increase in pH toward neutrality increases *C. trachomatis* infectivity, with 8.0% infectivity at pH 4, 14.8% at pH 5, 32.2% at pH 6, and 50.1% at pH 7.4.

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#### **REGULATION OF BONE MORPHOGENETIC PROTEIN (BMP7) GENE EXPRESSION IN HUMAN GLIOBLASTOMA CELLS.**

Erich Lutz, Michelle Chandley, Jessica Crawford, Attila Szebeni, Kate Szebeni, and

Dr. Greg Ordway. Department of Pharmacology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Bone morphogenetic protein 7 (BMP7) is a member of the Transforming Growth Factor-superfamily and has neuroprotective and neurotrophic effects on catecholaminergic neurons, as well as other neurons and

glia. BMPs were first discovered in bone, but are also expressed in the brain where they are involved in many aspects of differentiation and morphogenesis of neurons and glia, and play an active role in the mature brain. Low levels of BMP7 may contribute to noradrenergic neuron pathology in depression, and/or may be secondary to other deficits associated with depression. Decreased BMP7 gene expression in the locus coeruleus (LC) of patients with major depressive disorder (MDD) has been demonstrated by our laboratory using laser capture microdissection (LCM) which showed the deficit to be located specifically in LC astrocytes. In an effort to translate the BMP7 findings, human glioblastoma cells were treated with various synthetic and endogenous agents that are associated with the cellular pathology of depression to observe their effects on BMP7 gene expression levels. Quantitative PCR was used to determine changes in gene expression between treated and vehicle control groups. Cells treated with glutamate, norepinephrine, estrogen, and prostaglandin exhibited no significant changes in BMP7 gene expression. Treatment of cells with the beta-adrenoceptor agonist isoproterenol reduced BMP7 messenger RNA levels, while phenylephrine, an alpha-1 adrenoceptor agonist, did not alter BMP7 mRNA levels. This would indicate that signaling through distinct noradrenergic receptor pathways controls BMP7 gene expression. This is of particular interest given the importance of the NE system in antidepressant treatment and depression biology. Treatment of cultured glioblastoma cells with a glucocorticoid receptor agonist, dexamethasone, resulted in reduced expression of BMP7 mRNA in glioblastoma cells. This finding suggests that BMP7 levels in glia may be under the regulation of stress hormones, e.g. glucocorticoids, which are known to be elevated in depression. Ultimately, this work could reveal novel BMP7-targeted treatments for depression.

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## Natural Sciences & Mathematics

### DYNAMICAL BEHAVIOR OF THE DISCRETE-TIME LOGISTIC MODEL

Jason Beaulieu, Jeremy Brooks, Derek Cassel, Thomas Gemmer, William Jamieson, and Wesley Surber,  
Department of Mathematics, College of Arts and Sciences, East Tennessee State University, Johnson City,  
TN

The discrete-time logistic model is introduced to describe dynamical behavior of populations. We calculate fixed points and establish stability conditions. We carry out a graphical technique called cobwebbing. We discuss the existence and stability of periodic cycles and their dependence on a model parameter. Numerical simulations are used to obtain an orbital bifurcation diagram for the discrete-time logistic. We estimate model parameters from longitudinal observations about the growth of Paramecium aurelia in isolation.

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### THERMAL AND PHYSICAL BEHAVIOR PATTERN IN WEAK SHALE ROCK-MASS : A STUDY FROM SEVIER SHALE, TENNESSEE

Rachel Conde and Arpita Nandi, Department of Geosciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

The shales of the Southern Appalachian Basin are major producers of natural gas, which promises to generate much of our nation's natural gas supply in coming decades. As a result, shale is becoming increasingly important in the petroleum industry. The industries focus on the fundamental behavior of shale as a part of natural gas extraction plan, which becomes difficult as the shale behaves as a heterogeneous and complex rock-mass. The purpose of this research was to study the fundamental petrophysical behavior of varied shale. This study will help in order to provide a better comprehension of the petrophysical behavior of shale, which is important to consider for reservoir characterization, sedimentary basin analysis, exploration strategies, and potential borehole stability problem during gas exploration. Sevier Shale is a complexly folded, thrust-faulted, and diverse rock-unit that is present in the stratigraphic sequence of the

southern Appalachian Valley and Ridge Province. The study outlined an area of Sevier Shale in Washington, Sullivan and Carter Counties, in which thirty-six fresh rock samples were collected from outcrops, road cuts, and shale quarries where the rock is exposed. The pertinent petrophysical properties, such as density, porosity, permeability, water content, and specific heat capacity were quantitatively measured in the field, as were as laboratory-based testing. The petrophysical properties were measured using standard ASTM (American Society for Testing and Materials) methods. Statistical data were analyzed from the properties that were measured in each sample. The results indicates that properties like porosity, permeability and specific heat capacity varied significantly within samples, whereas density and water content yielded steady values. Histogram results indicate specific heat drastically reduced beyond 2.6 J/gm°C, most samples have a low porosity (7.12%), the bulk density of most samples were high (2.7 gm/cc), and that moisture content did not exceed 27.8 %. The variation in permeability could not be predicted due to a low sample size. Regression analysis was performed to evaluate possible correlations among the tested properties. In this analysis, specific heat capacity and porosity has a strong inverse relationship, which is also prominent in the relationship between heat capacity and moisture content. The bulk density and permeability of shale does not correlate with specific heat capacity. These results show that the thermal behavior of shale is dependent on porosity and moisture content.

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#### **DYE TRACING OF GROUNDWATER AND SURFACE WATER INTERACTIONS IN AN ACTIVE KARST AREA UNDER DIFFERENT FLOW CONDITIONS, CARTER COUNTY, TENNESSEE**

Rachel Conde and Yongli Gao, Department of Geosciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Many karst features such as caves, sinkholes, springs, and losing streams are founded to be connected to the Rock House Cave groundwater system in Carter County, northeastern Tennessee. Preliminary dye-tracing test by students and faculty at East Tennessee State University in September 2005 revealed that groundwater velocity is approximately 400-500 m/day during normal-flow conditions. To further investigate the flow conditions during a severe drought year, Fluorescein and Eosine liquid dyes were injected simultaneously in Dry Creek and Rock House Cave in November, 2008. Both dyes were detected in Cave Spring Cave, which merges into Buffalo Creek. Water samples were collected along cave conduits, surface streams, and springs during the tracing period. Tracer breakthrough curves were used to analyze water flow in the groundwater system. This analysis of the water samples indicate that this is a highly dendritic conduit flow system. Surface water disappeared from different locations along Dry Creek. No dyes were detected at upstream locations or other springs along Buffalo Creek, and the dye concentration decreases gradually along downstream locations. It takes more than a month for all the dyes wash into the karst aquifer from the losing stream - Dry Creek, during low-flow conditions. However, once the dye gets into the karst conduit, it is transferred very rapidly to its outlet, Cave Spring Cave. During high-flow seasons, Dry Creek remains in the surface channel and merges into Buffalo Creek. Dye tracing was conducted as part of the ETSU's karst field school activity during May and June of 2009. Rhodamine WT and Fluorescein liquid dyes were introduced at locations along Dry Creek, with one dye injected late and about one mile upstream of the other. Most of the dyes flew through surface channel and into Buffalo Creek. However, both dyes were also detected in Rock House Cave in less than two days, significantly faster than flow velocities from previous tracing test in 2005 and 2008. Eosine was also added into the groundwater system in Carter Saltpeter Cave, which was present in Results from recent tracing test indicate that high-flow conditions result in more rapid groundwater velocities in this active karst system.

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## **SUSCEPTIBLE-INFECTIVE-SUSCEPTIBLE DYNAMICS**

Alison Cox and Byron Roland, Department of Mathematics, College of Arts and Sciences, and Department of Computer and Information Sciences, College of Business and Technology, East Tennessee State University, Johnson City, TN

We study the dynamic behavior of an epidemic using a discrete-time Susceptible-Infective-Susceptible model. We discuss fixed points and periodic cycles. We explore the role of intra-specific competition on disease dynamics; where new recruits in a population compete for resources. If the total population is not a fixed point equilibrium the SIS model supports complex dynamics such as period-doubling bifurcations in its route to chaos. Datasets about mortality due to pneumonia and influenza are explored.

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## **AN EVALUATION OF CAFFEINE AS A HUMAN FECAL SOURCE TRACKER IN LOCAL STREAMS**

Joseph Fleetwood, Department of Environmental Health, College of Public Health, East Tennessee State University, Johnson City, TN

The purpose of this study was to evaluate the use of caffeine as an indicator of human fecal pollution and as a fecal source tracker. Municipal wastewater has the potential to degrade water quality and negatively impact human health by introducing xenobiotics and pathogens. Therefore, it is important to track fecal contamination sources so remediation efforts can be considered. The hypothesis of this study is that incomplete metabolism of caffeine, the increased availability of GC/MS, the decreasing GC/MS detection limits, along with the deficient removal of caffeine by Waste Water Treatment Plants (WWTPs) allow for the consideration of caffeine a potential indicator of fecal contamination. Several streams with varying land use patterns and potential fecal contamination sources were evaluated using Reverse Solid Phase Extraction (RSPE) and GC/MS detection in order to examine the effectiveness of caffeine as fecal source tracker. The resultant levels of caffeine were compared to the levels of coliform bacteria that were found to be present using the colilert—MPN technique. It is theorized that if human sources are contributing to the fecal contamination then caffeine should be present. Although caffeine is hypothesized to be a useful fecal source tracker in aquatic systems, some factors may limit the use of caffeine as such an indicator. Caffeine is found naturally in the environment and is contained in over 60 species of plants worldwide. This leads to the problem that caffeine is often present in urban environments from dumping of coffee grinds, teas, sodas, and other caffeine containing products. Another problem is that the methods used to detect and quantify caffeine—Reverse Solid Phase Extraction (RSPE) and GC/MS analysis—are complex and expensive compared to MPN-Colilert. The estimated cost of analysis was \$7.19 per sample and took an average time of 165 minutes to process 3 samples. Caffeine levels were identified at 4,206 ng/L upstream of the WWTP, spiked to 12,281 ng/L at the WWTP outfall, and declined to 9,632 ng/L downstream. This data indicates that caffeine responds to an increase in bacterial contamination from WWTP's. Other streams not influenced by WWTP's showed steadily declining caffeine concentrations; Boone Creek decreased from 8,879 ng/L to 3,746 ng/L, and Sinking Creek decreased from 530 ng/L to 66 ng/L over 3 sites. Caffeine can effectively be used to track fecal contamination sources; however the current bacteriological methods are more practical and economical.

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## **MODELING THE MICE INTERACTING PAIR OF GALAXIES USING A GENETIC ALGORITHM**

Coral Franklin and Beverly Smith, Department of Physics and Astronomy, College of Arts and Sciences, East Tennessee State University, Johnson City, Tennessee

When galaxies pass by one another in close encounters, tidal forces can produce features such as tails and bridges, which are made up of stars and gas. Computer simulations modeling gravitational interactions between the galaxies can reproduce these features. In this poster, we present a numerical simulation of the well-known interacting pair of galaxies known as 'the Mice'. Unlike previous simulations, this model was produced using a genetic algorithm, in which the principles of evolution are used to automatically find a good match to the system.

Funding and Support: NASA LTSA grant NAG5-13079, NASA Spitzer grants RSA 135814 and 1379558, and ETSU RDC Grant RD0094. Simulations were run on the ETSU computer cluster Blackpearl, consisting of 60 Dell 1950 Blade computers.

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## **DISPERSIBILITY OF COATED NANO-SILVER IN ORGANIC MEDIA**

Connie Alissa Manz Hinkle, Lee Williams and Aleksey Vasiliev, Department of Chemistry, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

The project is devoted to the development of novel silver-polymer nano-composites that can be used as effective X-Ray contrast agents. They might be based on colloidal dispersions of noble metals nanoparticles, however, their application is limited by low dispersibility of bare nanoparticles in organic media due to agglomeration and sintering. To overcome these problems, the surface of metal nanoparticles needs to be coated by an organic layer having a high affinity for organic media. This layer forms a physical or electrostatic barrier against agglomeration, changes the reactivity of the surface metal atoms and forms an electrically insulating film. As a starting material spherical nanoparticles with average diameter 160 nm and narrow size distribution were used. Samples of nanosilver coated by organic molecules with functional groups of different structure and molecular weight were prepared using thiolation method with the following thiols: alkylthiols C<sub>10</sub>-C<sub>18</sub>, benzeneethanethiol, 3-mercaptopropanoic acid, 3-mercaptopropan-1-ol and 2-aminoethylthiol. In most experiments the amount of chemisorbed thiol was 0.06-0.08 mmol/g. Obtained products contained hydrocarbon chains covalently attached to the surface. Surface densities of alkyl (aryl) groups were determined from chemical compositions of the materials (contents of C,N and S). The effect of coating of nanoparticles on their surface areas was studied using BET adsorption of nitrogen. Then dispersibility of modified samples in different solvents and the rate of their sedimentation (stability of colloidal dispersions) were determined. Bare and modified silver nanoparticles were dispersed in organic solvents with the use of ultrasonic probe. Presence of non-agglomerated nanoparticles was confirmed by UV spectrophotometry (absorption band of surface plasmon resonance at 470 nm). In accordance with obtained data, coated nanoparticles form stable dispersions in organic media. Results of this study showed that alkyl-functionalized nanoparticles (in contrast to bare silver) did not agglomerate in polar aprotic solvents (such as dimethylformamide, tetrahydrofuran and acetone). The nanomaterial and the solvent forming the most stable dispersions were selected for preparation of silver-polymer nanocomposites. They were obtained by mixing a colloid dispersion of silver containing surface stearyl groups in acetone with a polymer (polyacrylic or polylactic acid) solution. It was shown that no agglomeration of silver occurred in the polymer.

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**BIOLOGICAL AND CHEMICAL ANALYSIS OF BRUSH CREEK  
FROM FALL 2009 TO SPRING 2010  
[GROUP 1]**

Amanda Holley, Joshua Boggan, Jennifer Bannister, Heather Reynolds and Jason Panganiban, Department of Environmental Health, College of Public Health, East Tennessee State University, Johnson City, TN

Brush Creek, a stream located in the Watauga watershed in Johnson City, Tennessee located near East Tennessee State University, was sampled at three different sites over a nine month period. The three sites are located adjacent to ETSU intramural fields, behind Region's Bank and behind the Shell gas station both located on State of Franklin Road. Additionally, one sample was collected from the pond located on the Veterans Affairs campus in Mountain Home, Tennessee. At each sampling event environmental parameters such as dissolved oxygen, conductivity, pH, and temperature were measured to yield data that outlined seasonal transformations of a natural water system during the fall and spring seasons. Tests were performed on the samples from Brush Creek that utilize chemical and biological data to provide insight into the quality of the stream from both a human health and an aesthetic point of view. Weak acids, such as acetic acid, and their associated salts play an important role in natural water systems. The ability of a system to neutralize acids, referred to as alkalinity, is influenced by the salts of weak acids which are formed by carbon dioxide reactions with basic or organic materials in sediment. These equilibrium reactions, evaluated with titrations using Hach Kits, portable analytical instruments that easily measure an environmental parameter in the laboratory or sample collection site, are the basis for the carbonate-bicarbonate-hydroxide system of estimating the alkalinity of Brush Creek. Hardness, or the condition of a water system resulting from the presence of metallic cations, was measured in a similar method as alkalinity. Scale in household appliances arising from reactions of  $Mg^{2+}$  and  $Ca^{2+}$  hardness ions in natural waters with soap from laundering and personal hygiene can present aesthetic water quality concerns to the general public. Water systems, especially systems affected negatively by anthropogenic means including agricultural and industrial activity, can contain organic and inorganic solids that can be divided into total solids (TS), total suspended solids (TSS), and total dissolved solids (TDS). TDS in water systems contribute to water hardness because chemicals and metals in water bind to soil particles and are transferred downstream to form scale in pipes or household appliances. TS, TDS, and TSS of Brush Creek were measured using gravimetric analytical techniques. Microorganisms are present in nearly all aquatic environments, but different microorganisms grow efficiently at different physical and chemical conditions. To enumerate natural microorganisms in the water samples, conditions such as pH, nutrients, and temperature were applied. The growth of microorganisms at specific conditions is useful for detection of pollution such as the coliform group of microorganisms that indicate the presence of human and animal feces. Combined data from Groups 1 and 2 provide insight into the quality of Brush Creek compared to limits set by the State of Tennessee.

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**ISOLATION AND IDENTIFICATION OF THE GENES INVOLVED  
IN THE BIOSYNTHESIS AND TRANSPORT OF VICIBACTIN,  
A TRIHYDROXAMATE SIDEROPHORE PRODUCED BY RHIZOBIUM LEGUMINOSARUM  
ATCC 14479**

Sarah Hoss, William Wright, and Dr. Ranjan Chakraborty, Department of Health Sciences, College of Public Health, East Tennessee State University, Johnson City, Tennessee

Rhizobia are agriculturally beneficial bacteria that form nodules on the roots of leguminous plants such as beans, peas, and soy. Rhizobia have an elevated need for iron as a component of nitrogenase, which is the enzyme responsible for the fixation of atmospheric nitrogen into ammonia. To overcome the shortage of available iron in the rhizosphere, rhizobia and many other microorganisms secrete molecules called siderophores into the environment to chelate ferric iron with extreme affinity and transport it into the cell. *Rhizobium leguminosarum* ATCC 14479 has been shown to produce vicibactin, a trihydroxamate type siderophore. However, little is known about how *R. leguminosarum* transports the ferric vicibactin into the cell. Most of the research in this field has been conducted using *E. coli* as a model; though siderophore

mediated iron transport in rhizobia should also be considered because of their agricultural importance. This ongoing research includes identification and isolation of the genes coding for regulation, biosynthesis, and transport of vicibactin. This is being accomplished by designing primer sequences from a known rhizobial vicibactin operon. These primer sequences are used to probe the chromosomal DNA for vicibactin biosynthesis genes using polymerase chain reaction to amplify the genes. The genes are then separated using agarose gel electrophoresis. QIAamp kits were used to isolate chromosomal DNA. Initial results indicate that vicibactin synthesis in *R. leguminosarum* ATCC 14479 may be regulated by an operon similar to an eight gene operon reported in other *R. leguminosarum* strains. Confirming that this operon is present and sequencing the genes will be attempted. The research also explores the transport of siderophores via outer membrane protein in *R. leguminosarum* ATCC 14479. Cultures are grown in minimal media with iron concentrations that support optimum siderophore and transport protein expressions. The presence of the outer membrane protein is then assessed using a combination of SDS-PAGE and Western Blot techniques. Preliminary data indicates that the outer membrane protein fhuA may be responsible for vicibactin uptake in *R. leguminosarum* ATCC 14479. Extended research plans include cloning the gene that codes for the outer membrane protein, overexpression, and protein purification for crystallization to determine structure. This research will be useful in further elucidating the transport mechanisms and genetic regulation of siderophores in rhizobia. The research may further contribute to the understanding of siderophore mediated iron transport systems in other bacteria including human pathogens.

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### **THE ROLE OF SA-METHYL TRANSFERASE II IN PLANT MEDIATED DEFENSE**

Tazley Hotz and Dhirendra Kumar, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Salicylic acid (SA) plays an important role in the defense responses against microbial pathogens in plants. SA is lipid immobile and may not pass through the chloroplast membranes to enter into the cytoplasm where mediation of the disease resistance signaling occurs. It has been recently suggested that SA synthesized in the chloroplast is converted into lipid mobile methyl salicylate (MeSA) by an enzyme, salicylic acid methyl transferase (SAMT). MeSA, which is highly volatile, has been shown to be an important signaling molecule in systemic acquired resistance (SAR). To investigate the role played by SAMT in SA-mediated disease resistance signaling, we examined the expression of SAMT in response to tobacco mosaic virus (TMV) and defense inducing chemical signals like SA, methyl jasmonate (MeJA), and benzothiadiazole (BTH). Expression studies were performed using semi-quantitative Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR). To investigate the role of SAMT in plant immunity, we have produced stable transgenic tobacco plants silenced in the expression of SAMT. Effective silencing of endogenous SAMT in these transgenic plants was determined using semi-quantitative RT-PCR. To determine the role of SAMT in disease resistance, these transgenic lines were challenged with the viral pathogen, tobacco mosaic virus (TMV). SAMT silenced transgenic plants were not remarkably deficient in systemic acquired resistance (SAR). To carry out RNAi silencing, SAMT II was utilized; however, other SAMT genes, including SAMT I, may be important in plant disease resistance. Protein expression studies will be performed to characterize SAMT II. Understanding the biochemical pathways involved in plant defense responses against pathogens will help to develop crop plants showing better resistance to ever-evolving pathogens and reduce our dependence on pesticides.

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### **MULTIWAVELENGTH COMPARISON OF INTERACTING GALAXIES**

Sabrina Hurlock and Dr. Beverly Smith, Department of Astronomy, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

We will perform a multi-wavelength study of interacting galaxy systems selected from the Arp Atlas of Peculiar Galaxies (Arp 1966). We will compare ultraviolet observations from the GALEX (Galaxy

Evolution Explorer) instrument with the 21 centimeter HI (neutral hydrogen lines) radio observations obtained by VLA (Very Large Array). By creating and overlaying contours from the HI images onto the ultraviolet GALEX images, we are able to compare and contrast regions of interest, such as tidal tails, bridges, possible tidal dwarf galaxies, and regions with high star formation.

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### **BIOLOGICAL AND CHEMICAL ANALYSIS OF BRUSH CREEK FROM FALL 2009 TO SPRING 2010 [GROUP 2]**

Thomas Jarratt, Kaitlin Justus, Brandon Rogers, Jeremy Woody, and Joseph Fleetwood, Department of Environmental Health, College of Public Health, East Tennessee State University, Johnson City, TN

Aquatic species require nutrition, respiration, and certain other factors to compete and reproduce—without these essential elements they will not survive. Brush Creek is located in a populated area of Johnson City, TN and was the stream analyzed with both biological and chemical tests in conjunction with another group doing separate tests. Concentrations of phosphates, nitrates, ammonia, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Total Organic Carbon (TOC) were examined in Brush Creek, located between East Tennessee State University and The Veteran Affairs Hospital. Samples were collected in both fall and winter months with environmental parameters measured on each sampling trip including; conductivity, pH, dissolved oxygen, and temperature. Phosphates and nitrates were evaluated using the HACH procedure and compared with results obtained using manual titration. HACH kits streamline the manual titration method by containing simple, pre-packaged reagents and a small spectrophotometer for quick analysis. Nitrogen and phosphorous are important nutrients for growth and are the main constituents in fertilizer which can lead to eutrophication in surface water. Values obtained were low at an average of 0.20 mg/L for both nitrate and phosphate. The BOD<sub>5</sub> test is a measure of the amount of oxygen consumed over 5 days, an average net consumption of 15.5 mmol O<sub>2</sub>/m<sup>3</sup>/day was recorded. COD was measured using a COD digester and its concentration was measured using a spectrophotometer. COD is measured by wavelength response from the spectrophotometer and an excessive reading is >40 mg/L. An average value of 0.230 mg/L was obtained from Brush Creek. The ammonification procedure produced a dark yellow color, which indicated an excess of ammonia in the sample; a yellow color indicates the presence of ammonia, and a darker yellow to brown color indicates a higher concentration of ammonia. Finally, TOC was analyzed using a LiquiTOC analytical instrument. TOC values were consistent with nitrate and phosphate values. The combined values from Group 1 and Group 2 give an indication as to whether remediation is needed and to what extent when compared to Tennessee state limits.

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### **FOREST CHANGE IN HIGH ELEVATION FORESTS OF MT. MITCHELL, NORTH CAROLINA: RE-CENSUS AND ANALYSIS OF DATA COLLECTED OVER 40 YEARS**

Laura Lusk<sup>1</sup>, Matt Mutel<sup>2</sup>, Elaine S. Walker<sup>3</sup>, and Foster Levy<sup>1†</sup>.

<sup>1</sup> Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

<sup>2</sup> Mount Mitchell State Park, 2388 State Highway 128, Burnsville, NC

<sup>3</sup> James H. Quillen Veterans Affairs Medical Center, Mountain Home, TN

† Corresponding author

The Black Mountain range of western North Carolina supports some of the most extensive, but threatened high elevation forests in the southern Appalachians. Of particular note, the insect pathogen, balsam woolly adelgid (*Adelges piceae* Ratzeburg) has been present on Mt. Mitchell for over fifty years. In anticipation of potential changes in forest composition, vegetation surveys were first conducted in 1966 on nine one-acre plots near the summit of Mt. Mitchell. These plots were re-surveyed in 1978, 1985 and 2002. The purpose

of this study was to re-census those plots and use those data to analyze long-term trends in forest composition for fir, spruce-fir, and spruce-fir-hardwood forest types. Since the 1960s and 1970s, all three forest types have experienced a transition away from an understory with a preponderance of Fraser fir (*Abies fraseri* (Pursh) Poir.) seedlings and saplings, to forests with higher densities of canopy and sub-canopy fir. Canopy red spruce (*Picea rubens* Sarg.) has similarly increased in density in the fir and spruce-fir types but declined in the spruce-fir-hardwood forest type. In all types, there has been a sharp decline in hardwood seedlings/saplings since a hardwood seedling explosion in 1978. The current analyses indicate that fir and spruce-fir forests have regenerated since the most severe die-offs and that each forest type will experience future impacts from balsam woolly adelgid but these will occur in a non-synchronous pattern.

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### **POPULATION GROWTH STRATEGIES AS A RESPONSE TO CROWDING**

Emil Montano and Istvan Karsai, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

An organism is always kept from multiplying uncontrollably in an environment by a number of factors. One very important factor is density dependency with other organisms of the same species. Organisms of the same species will use up the same resources and only a certain number of individuals will be able to survive. To determine how the maximum population of a species differs at different levels of density, we created a simple model. Using this model, different life history strategies were simulated. One of the simulations involves a single species that moves randomly and breeds if it is not constricted by its set density capacity for a given crowdedness. The amount of individuals that can survive within a set density capacity was studied at different levels for each condition. The second simulation carried out with stationary trees put under the exact same density capacity conditions where the tree produced a seed randomly in the environment, and 10 trials were also run for each level. A lake was then added to the stationary trees simulation in which trees could not live. The result for each simulation was very similar in which the population grew in a sigmoid manner as the number of individuals increased. We studied the relationship between the carrying capacity of the system and the sensitivity for crowdedness of the organisms.

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### **CLOTHING AND CHARACTERIZATION OF POTATO HOMOLOG OF TOBACCO SA-METHYL ESTERASE AND ITS ROLE IN DISEASE RESISTANCE**

Yutika Patel and Dhirendra Kumar, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Salicylic acid is a plant hormone which plays an important role in disease resistance response against plant pathogens. SABP2 (salicylic acid-binding protein 2), a 29 kDa protein binds salicylic acid with high affinity and converts inactive methyl salicylic acid (MeSA) produced in plants resisting pathogen infection into active SA. Increased levels of SA leads to changes in redox potential of the cytoplasm resulting in breakdown of oligomeric NPR1 protein into its monomers. Monomers of NPR1 then migrate to the nucleus to activate transcription of defense genes. SABP2 plays critical role in both local and systemic acquired resistance in plants. SABP2 has been identified from tobacco plants where the endogenous SA level is much lower (40-100 fold) than in potato and rice plants. Does SABP2 homolog in potato plants function as tobacco SABP2 does in tobacco? To answer this we are silencing potato homolog (STSABP2) of SABP2 using RNAi. BLAST search using NtSABP2 (tobacco SABP2) showed that SGN U273369 (STSABP2, putative potato homolog) to be the most similar potato gene to the tobacco SABP2. The full length STSABP2 cDNA was amplified by using the RTPCR. The amplified DNA was then sequenced and compared to the known DNA sequence (SGN U273369). After verification, the fragment was cloned in both the sense and the antisense orientation in the RNAi plant expression vector pHANNIBAL. The

pHANNIBAL containing STSABP2 cDNA was then sub cloned into a binary plasmid pART27. The construct was then transformed into *Agrobacterium tumefaciens* (LBA 4404) which was then used for generating transgenic potato plants by transforming potato internodes. Stable transgenic potato plants are being generated and once ready, they will be challenged with viral and bacterial pathogens to assess the role of SABP2 in local and systemic acquired resistance. Understanding the biochemical pathways involved in plant defense response against pathogens directly in the crop plants will help to develop crops with better resistance to ever-evolving pathogens.

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### **SITE DIRECTED MUTAGENESIS TO STUDY THE MOLECULAR MECHANISM OF SIDEROPHORE MEDIATED IRON TRANSPORT IN *ESCHERICHIA COLI*.**

Ada Reynolds, Jennifer Cooke, Erin Storey, Ranjan Chakraborty, and Dick Van der Helm, Department of Health Sciences, College of Public Health, East Tennessee State University, Johnson City, TN and Department of Chemistry and Biochemistry, University of Oklahoma, Norman, OK.

The importance of iron to bacteria has resulted in the evolution of a variety of iron acquisition methods. One of these methods is the production and secretion of iron chelating molecules known as siderophores. Outer membrane transport proteins composed of a  $\beta$ -barrel with a globular plug mediate the uptake of these siderophores by the cell. There are two possible ways in which the plug can move to allow the siderophore complex to pass through the barrel, it can either drop through the barrel or undergo a conformational change within the barrel. The scientific community is currently in debate regarding the exact mechanism of action of the plug so the purpose of this study is to provide conclusive evidence for one mechanism. The FhuA mutants 72/615C and 72/615/109/356C developed by site directed mutagenesis, prevent movement of the plug domain by the formation of disulfide bonds but are still capable of transport and binding equivalent to the wild-type. The extraction, purification, and crystallization of these proteins, however, will be required in order to verify that the structural changes in the protein are limited to those made by the site-directed mutagenesis

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### **THE EFFECT OF FIRE TO ECOSYSTEM DYNAMICS**

Byron Roland and Istvan Karsai, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

The Gray Fossil Site has the largest population of tapir fossils. Studies at this site indicate that the tapirs lived in a forest that was commonly ravaged by fires. In this study the interesting dynamics between the plants, animals, and fires were mimicked as well as the consequences of forest destruction. A simple model was developed in Netlogo, an agent based modeling environment, to reenact the life of tapirs. For simplicity sake we assumed a very basic life history using birth, growth, reproduction, and death of the tapirs as well as birth, reproduction, and death of trees. These tapirs and trees are also prone to death by natural disasters. This was modeled by the occurrence of yearly fires. The dispersion of the fire is dependent upon the place of initiation and the amount of fuel available, which corresponded to the density of the trees. Using the Netlogo model, numerous simulations were run to predict how the tapir population was able to survive the fires and habitat destruction. It was found that the survival of the tapirs is dependent upon the density of the trees, the life history parameters of the tapir, and from random events such as fires.

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## PATTERN OF SKELETAL DEVELOPMENT IN AN Oviparous Snake

Whitney Trotter Ross<sup>1</sup>, Dr. Rebecca Pyles<sup>1</sup>, Dr. James Stewart<sup>1</sup>, and Dr. Thomas Ecay<sup>2</sup>.

<sup>1</sup>Department of Biological Sciences, College of Arts and Sciences

<sup>2</sup>Department of Physiology, Quillen College of Medicine,  
East Tennessee State University, Johnson City, TN.

Study of skeletal development in vertebrates serves as an important source of evidence for functional, systematic, evolutionary, and developmental questions. Skeletal development has been studied extensively in fishes, amphibians, birds, and mammals; however, such studies are particularly lacking for squamate reptiles—lizards and snakes. Most previous studies of squamate skeletal development have been based on small sample sizes, have not reported variation, and have utilized embryo or postnatal size to compare specimens. Because size varies considerably among species and with incubation temperature, results of these studies are not comparable. This study was designed as a baseline study of skeletal development in an egg-laying (oviparous) snake, *Pantherophis guttatus*, commonly called the corn snake. Data from this study are intended to provide a ‘developmental clock’ describing the uptake and use of calcium for ossification of the embryonic skeleton. A complete developmental series of 76 embryonic corn snakes were identified to embryonic stage based on external morphology and specimens were cleared and double-stained to reveal bone (alizarin red) and cartilage (alcian blue). A measure of the lower jaw (Meckel’s cartilage) was used to represent relative growth. Initial sites of ossification appeared in the vertebral centra of the upper spinal region (stage 29) and the palatine bone of the cranium (stages 29–31). Ossification of the vertebral column proceeded in an anterior to posterior gradient for centra and neural arches (stage 32–37). However, the neural spine and ribs did not follow this pattern, but ossified at approximately the same rate throughout the vertebral column (stage 33–37). During stage 32, ossification of the mandible (prearticular, suprangular) and one jaw suspensory bone (pterygoid) proceeded quickly, while the upper jaw and skull roofing bones showed only initial centers of ossification. Just prior to hatching, most bones were completely ossified, except for the parietals, occipital complex, and basisphenoid of the cranium and the tail vertebrae. Results show that calcium mobilization to the embryonic skeleton occurs earlier in development than suggested by earlier studies. Previous suggestions that the snake skeleton ossifies exclusively in an anterior to posterior pattern were refuted; vertebrate development actually occurs in a complex pattern involving numerous centers of ossification. The study provides a model approach that provides a basis for future investigations of skeletal development and calcium mobilization during development.

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## ADAPTIVE SELF-ORGANIZED TASK ALLOCATION IN WASP COLONIES

Andrew Runciman<sup>1</sup> and Istvan Karsai<sup>2</sup>,

<sup>1</sup>Department of Computer and Information Sciences, College of Business and Technology, and

<sup>2</sup>Department of Biological Sciences, College of Arts and Sciences,  
East Tennessee State University, Johnson City, TN

Many species of wasps are social and construct nests. The construction of a nest requires that pulp be gathered, which also requires the collection of water in order to combine it with cellulose to make the pulp. After the necessary resources are collected, time and effort must be spent adding that pulp onto the surface of the nest. Rather than having a large number of wasps that perform all of the required tasks in sequence, when the population of a wasp colony is large, the majority of workers in that colony will be specialized in one particular job. The division of labor in *Metapolybia* wasps in particular allows for some wasps to remain on the nest and distribute water that has been collected by water foragers, acting as a common stomach for the rest of the colony. This mechanism of the common stomach creates worker connectivity, through increased local interactions amongst wasps. All of this complex organization within the nest is an emergent property of interactions and material-exchanges between self-organized individual wasps. In order to explore the regulation of task partitioning in wasp colonies, we built a series of computer models to simulate the system of material collection and exchange described above. Our models are based on cellular automata, where wasps on a grid representing the interaction platform perform jobs according to specific

rules. Wasps may act as pulp foragers, water foragers, or common stomach wasps (who can also act as builders). When wasps are close enough to each other, the wasps will interact according to the rules of interaction between their job types and the resources they're carrying. The amount of water that can be exchanged in an interaction is smaller than a wasp's maximum stomach capacity, requiring multiple interactions to fill or unload a stomach. Water exchanges are also governed by a resistance function, which gives common stomach wasps a lower probability of accepting water when they already are nearly full, and gives them a low probability of giving away water when their stomachs are close to empty. After a pulp forager has collected a full load of water, or after a water forager has unloaded a full stomach of water, both types of foragers will leave the nest for a specified span of time in order to collect resources. In the model, wasps are exposed to predators while away from the nest and run a small risk of being killed. Wasps also have a chance of changing jobs, which is controlled by simple rules relating to their time spent attempting to make material exchanges. Our findings thus far have demonstrated how the efficiency of low-risk work force strategies such as the common stomach is affected by colony size and resource availability. In cases of high population density, forager wasps were made more efficient through greater connectivity. We have showed that in all cases except for those of very low population density, the common stomach is an effective method of increasing production while reducing exposure to predators.

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#### **IDENTIFICATION OF PHOSPHATE BINDING RESIDUES IN THE CATALYTIC SITES OF *ESCHERICHIA COLI* ATP SYNTHASE**

Saurabh Sachan, Mai Xiong, Nitin Sachan, and Zulfiqar Ahmad. Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

F<sub>1</sub>F<sub>0</sub> ATP synthase is responsible for ATP synthesis in animals, plants, and all microorganisms. ATP synthase functions like a motor and is in fact the smallest known biological nanomotor. Accordingly, this enzyme can be used as a base model in the development of nanomotors in nanomedicine usage. In order to use this, or any other enzyme, as a base model, it is of paramount importance to understand the catalytic function. Pi (inorganic phosphate) plays a critical role in allowing the binding of ADP to generate ATP. There are many conserved motifs in and around the catalytic sites which may be responsible, individually or collectively, for Pi binding. The a-subunit VISIT-DG sequence is one of them. For this purpose we have constructed thirty-four mutants. All the VISIT-DG sequence residues were replaced with A/D/Q/R in a single or double fashion. Our initial growth and biochemical assays demonstrate that some of the VISIT-DG sequence residues are either directly or indirectly involved in Pi binding, and some are only required for structural maintenance of the Pi binding subdomain. Here the results will be discussed.

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#### **EFFECT OF MICROGRAVITY ON MOUSE UTERINE TISSUE MORPHOLOGY**

Sara Scobee and Allan Forsman Ph.D., Department of Health Sciences, College of Public Health, East Tennessee State University, Johnson City, TN

With the advent of space flight, many questions have been raised regarding the effect of microgravity on the various body systems. Analyzing the uterine tissue of mice subjected to the microgravity of spaceflight is one way to determine the effect of space flight on female reproductive tissue. The three main components of uterine tissue are the myometrium, endometrium and the lumen. It is hypothesized that the microgravity of space flight would have a noticeable effect on the morphology of uterine tissue, including the thickness of the endometrium and myometrium and the abundance of glands in the endometrium. Uterine tissue was obtained from mice flown on NASA space shuttle flight STS 118. Three different treatments of mice uteri were compared. These treatments included baseline (cage mice), flight mice, and ground control (mice on the ground, whose cage environment mimicked flight cage conditions in regard to temperature, humidity, and light/dark cycles, but delayed 48 hrs). After the flight, the tissues were

harvested and paraffin embedded using standard embedding techniques. The tissue was sectioned in 5 m sections, mounted on slides and stained using Periodic Acid Schiff staining. Following staining the tissue was analyzed under the light microscope. This analysis included the thickness of the endometrium and myometrium and an estimate of the density of the secretory glands in the endometrium.

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### **ANTIMICROBIAL/ANTICANCER PEPTIDES INHIBIT *Escherichia coli* ATP SYNTHASE**

Steven D Sherman, Mohammad I Bowers, Junior Tayou, Thomas F Laughlin, and Zulfiqar Ahmad,  
Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University,  
Johnson City, TN

F<sub>1</sub>F<sub>o</sub>-ATP synthase is the primary source of cellular energy production in animals, plants, and almost all microorganisms by oxidative or photophosphorylation. ATP synthase is a highly conserved and structurally similar enzyme in all organisms. This enzyme is also the smallest known biological nanomotor and is composed of two rotary sectors, F<sub>1</sub> and F<sub>o</sub>. ATP synthase is critical to human health and its malfunction has been implicated in a wide variety of diseases such as cancer, tuberculosis, neuropathy, Alzheimer's, Parkinson's, and mitochondrial myopathies. This enzyme is also a likely therapeutic target in the treatment of diseases such as, cancer, heart disease, immune deficiency, cystic fibrosis, diabetes, ulcers, and tuberculosis. Recent studies have shown the presence of ectopic ATP synthase on the surface of several animal cell types where ATP synthase is associated with multiple cellular processes including agiogenesis, lipid metabolism, regulation of intracellular pH, and apoptosis. A wide range of natural and synthetic products including polyphenols and peptides are known to bind and inhibit ATP synthase. These inhibitors may bind to ATP synthase and block ATP synthesis in tumor cells, thereby leading to apoptosis. Several basic peptides including the honey bee venom peptide melittin, and amphibian MRP form basic amphiphilic a-helical structures with a proposed binding site at the bDELSEED-motif of the F1 subunit. Here we will discuss the role of antimicrobial/anticancer peptides as inhibitors of ATP synthase.

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### **EPIDEMIOLOGICAL PROCESS ON RANDOM GRAPHS**

Wesley Surber, Department of Mathematics, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

A random graph is a graph that is generated with a given amount of vertices and then edges are added to make connections between the vertices at random. I will be using the Poisson distribution to create the edges of the vertices. Using this random process creates certain graph properties: degree distributions, clustering, and network correlations. Properties of graphs also include their resilience or how resistance they are in keeping connections and eccentricity even after deleting edges and community structure which relates to clustering. Random graph provide a model of community structure to study an epidemiological process. I will be using a SLAIR model to simulate an infectious disease on communities with random graph structure. The SLAIR model contains five different epidemiological states that a vertex can have: susceptible, latent, asymptomatic, infected, and recovered. I will compare the results of the random graphs to the deterministic values of the pair approximations of the graph.

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## **PERSISTENT AND RETICENT FORAGING BEHAVIORS IN HONEY BEES (*APIS MELLIFERA*)**

Ashley E. Wagner, Byron N. Van Nest, Caddy Hobbs, and Darrell Moore, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Classical experiments on honey bee time-memory showed that foragers trained to collect food at a fixed time of day will return the following day with a remarkable degree of time-accuracy. Based on prior work, we have found that not all time-trained foragers visit the training station on an unrewarded test day immediately following the last day of time-training. Rather, the trained foraging group appeared to be comprised of two sub-groups: persistent bees and reticent bees. Both sub-groups cluster on the dance floor in anticipation of the training time, and persistent bees then leave the hive to reconnoiter their food source. Reticent bees, however, will not make reconnaissance flights to the training station until they observe a recruitment dance from another bee confirming the availability of their source. An experiment was designed to examine this pattern of behavior to determine what factors during training days were significant determinants of behavior on subsequent unrewarded test days. For this, an extinction experiment was carried out. This entailed training forager bees in an observation colony to a sucrose feeder and allowing them to forage from it for a restricted period of time (1.6h) at the same time every day for eight days. Immediately following the training days, three test days were carried out, during which the feeder was unrewarded. Observations were made at the training station and the colony itself on both training and test days, and a video camera was positioned at the hive entrance on test days. Data analysis revealed a positive correlation between persistence on test days and the number of rewards a forager received at the training station as well as the number of days of experience at the feeder. However, the significance of these correlations decreased with each subsequent test day. Our results suggest that our initial definitions of persistent and reticent foragers are inadequate. Rather, each of these groups includes a subgroup of foragers that appear to be working another food source while retaining a time-memory for the unrewarded experimental feeder. The proportion of these extracurricular flights relative to total flights from the colony increased with each subsequent test day. Finally, we identified yet a fifth class of forager instead of visiting the feeder every day during consecutive days of training, these bees sporadically skipped one or more training days. Predominantly, these particular foragers exhibited reticent behavior on test days. The adaptive significance of these various foraging subgroups remains to be determined.

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## **PHASE LAGS IN THE OPTICAL-INFRARED LIGHT CURVES OF ASYMPTOTIC GIANT BRANCH STARS**

Jessica Webb and Beverly J. Smith, Department of Physics and Astronomy, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Searching for phase lags in the optical-infrared light curves of asymptotic giant branch stars, we have obtained optical light curves from the AAVSO database for an initial sample of 161 stars. We have cross correlated this with infrared data from the COBE DIRBE Point Source Catalog, and have found 46 stars with phase lags between the times of infrared and optical maximum. There is a distinct difference in some of the Mira and Semiregular variable stars with the Mira variables having larger phase lags. In this project, we are expanding previous studies of the phase lags to a much larger sample and over a larger amount of time. With more data, we have full variability for many stars, filling in visibility gaps, and giving information on cycle to cycle changes.

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# Social & Behavioral Sciences

## THE MORAL OF THE STORY: THE EFFECTIVENESS OF PARABLES ON FORGIVENESS

Ashley Agin, Department of Psychology, Milligan College, Milligan College, TN

The aim of the present study was to investigate the link between perspective taking and forgiveness. Measure of forgiveness included attitudes towards forgiveness and tendencies to forgive transgressions in the past and future. Fifty college students participated in an internet based experiment. This study found that manipulation of perspective taking through religious priming significantly increased forgiveness. Among the participants, those who were primed with a religious story of forgiveness before taking the questionnaire reported higher levels of forgiveness than those who were not and those who were primed to feel empathy for the offender were more forgiving than those primed to relate to the victim. These findings suggest that perspective taking does have an effect on forgiveness and that religious parables are an effective tool in evoking forgiveness.

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## DEPRESSION AND SUICIDE: THE PROTECTIVE ROLE OF HOPE IN COLLEGE STUDENTS.

K. Bashor, K. L. Walker, R. Swafford, and J. K. Hirsch, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Suicide is a significant problem among college students, and is the 2<sup>nd</sup> leading cause of death on college campuses. College students often report depressive symptoms, and many students experience their first depressive episode in college. Research indicates that high levels of depression are a predictor of suicidal ideation and attempts; not all individuals who are depressed become suicidal, however. Cognitive-emotional characteristics, such as trait hope, may buffer the relationship between depressive symptoms and suicide outcomes. Hopefulness is conceptualized as “an overall perception that goals can be met,” and has been proposed to have two dimensions: pathways and agency. Agency thinking is defined as thoughts people have about their perceived ability to initiate and continue goal-directed behavior, whereas pathways thinking is considered a problem-solving route toward the achievement of goals. To our knowledge, this is the first published data examining depressive symptoms, suicide behaviors, and hope in a college student population. We investigated the relationship between depressive symptoms, suicide behaviors, and hope. We hypothesized that greater levels of depressive symptoms would be associated with increased suicide behaviors, and that trait hope would moderate this relationship, such that depressed students who reported greater levels of hope would be less likely to report self-harm. Our sample of 439 participants (71% female; 91% Caucasian; Mean Age = 21.02, SD = 6.11) were recruited from a rural Southeastern university. Participants completed the Beck Depression Inventory (BDI), Suicidal Behaviors Questionnaire (SBQ) and the Trait Hope Scale (THS). At a bivariate level, depressive symptoms were significantly positively associated with suicide behaviors ( $r=.508$ ,  $p<.01$ ). In the multivariate model, greater levels of depressive symptoms significantly predicted greater total score on the SBQ, and the total hope score moderated this relationship ( $t=-2.039$ ,  $p<.05$ ,  $UnB=-.003$  [ $SE=.002$ ]). Students who endorsed symptoms of depression and had higher levels of hope were less likely to endorse suicide behaviors. Exploratory analyses utilizing the Trait Hope subscales (agency and pathways) revealed that the agency subscale significantly moderated the relationship between depressive symptoms and suicide behaviors ( $t=-2.508$ ,  $p<.05$ ,  $UnB=-.006$  [ $SE=.003$ ]); pathways did not. Individuals able to maintain goal-oriented behavior in the context of depression may be less vulnerable to suicide risk. Our findings extend research in this area and imply that trait hope may serve as a buffer between depressive symptoms and suicide outcomes. Limitations of our study include the predominance of females and Whites, which may limit generalizability. Use of cross-sectional data

precludes examination of causal factors. Our findings may have clinical implications; the promotion of hopefulness in the context of depression may mitigate the likelihood of self harm.

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### **RAPID RESPONSE TEAM ACTIVATION KNOWLEDGE RELATED TO REGISTERED NURSE EXPERIENCE**

Casey L. Bayliss and Joy E. Wachs , Ph.D., Department of Family and Community Nursing, College of Nursing, East Tennessee State University, Johnson City, TN

Rapid Response Teams are used in health care facilities to intervene when a patient is deteriorating. These teams have shown to better patient care in health care facilities if utilized correctly, but barriers to utilization could hinder patient care. An eight-item questionnaire, five scenarios and three questions pertaining to registered nurse experience was distributed to staff registered nurses on three different units at a Top 100 Heart Hospital. The purpose of this study was to determine if the number of years of registered nurse experience or total intensive care unit experience was related to the likelihood that a registered nurse would activate the Rapid Response Team system. The results of this study identified that registered nurses with more years of experience were more likely to activate the Rapid Response Team at their facility. This study will be useful in registered nurse education and continuing education programs at the facility. This education on utilization can lead to a decrease in patient deterioration.

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### **GOOD GOD, MY GPA IS AWESOME! RELATIONSHIPS BETWEEN CHURCH ATTENDANCE, ACADEMIC SELF-EFFICACY, AND ACADEMIC SUCCESS**

Rose A. Bell, Desta A. Taylor, Carl White, Dexin Shi, Benjamin Martin, and Chris S. Dula, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Motivational and self-esteem factors contribute significantly to adolescents' performance on standardized tests in math and science (Long et al., 2007). In addition, ego strength is positively correlated with higher GPA among high school students (Freeman, 2003). Self-efficacy has been thought to have a greater positive impact on academic success than interest in academic goal-setting (Long et al., 2007). Religiosity has been associated with increased church attendance (Mitchell & Weatherly, 2000). Often church attendance has been used as a proxy measure of religiosity (Francis & Gibson, 1993, Markides, 1983). The impact of religiosity on the psychological well-being of adolescents has also been considered to be positive. For example, a study among rural New England adolescents showed that females who reported higher rates of attendance at religious services and males who reported higher rates of the importance of religion to them personally, both had higher rates of self-efficacy (Milot & Ludden, 2009). Furthermore, high school students with higher participation in faith-related activities scored higher on measures of hope and competence (Freeman, 2003). This study seeks to assess the relationship between church attendance, self-efficacy and GPA. Participants included 1,251 students and their parents from rural Southeastern middle schools. Data have been collected and will be analyzed presently. Results from this study may give further insight to how church attendance and self-efficacy may affect academic performance. Furthermore, results may aid both religious and school counselors for possible methods of intervention to improve the performance of students. Future research should focus on assessing the effects different types of religions and fundamentalism have on academic performance.

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## **WEIGHT CONCERNS AND BODY IMAGE AS RELATED TO COMPENSATORY BEHAVIOR AMONG RURAL PREGNANT WOMEN**

Kristen Carlosh, Suzanne Allen, William T. Dalton III, and Beth Bailey, Department of Psychology, College of Arts and Sciences and Department of Family Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Weight concerns have been identified as a contributing and maintaining factor in smoking behavior. Additionally, smoking has been identified as a weight-related compensatory behavior; therefore, weight concerns among women who smoke may be predictive of other compensatory behaviors. Our objective was to examine the relationship between weight concerns/body image and compensatory behaviors among rural women who smoke during pregnancy. We hypothesized that greater weight concern/body image dissatisfaction at 1<sup>st</sup> trimester would predict the following at 3<sup>rd</sup> trimester 1) greater compensatory behaviors, and 2) less pregnancy weight gain. As part of the Tennessee Intervention for Pregnant Smokers (TIPS), forty pregnant smokers were recruited at a first trimester prenatal health care visit and assessed throughout pregnancy. Participants completed a battery of measures including the Weight Concern Scale (WCS), Body Image Concern Inventory (BICI), and Eating Attitudes Test-26 (EAT-26), which assesses compensatory behaviors. Weight was assessed using self-report and anthropometric measures gathered at doctors' visits. WCS and BICI scores were significantly correlated with the EAT-26 scores ( $p < .05$ ). In a multiple regression analysis, demographic variables (i.e., age, income, education), WCS scores, and BICI scores were regressed on EAT-26 scores, yielding a significant effect ( $F = 6.65$  [5, 16],  $p < .01$ ). However, standardized beta coefficients showed that BICI score ( $\beta = .67$ ,  $p < .01$ ) was the only significant predictor. Thus, greater body image concerns surveyed in 1<sup>st</sup> trimester predicted more engagement in eating disordered behaviors by 3<sup>rd</sup> trimester among smoking pregnant women. Targeting body image early in pregnancy could counteract the development of potentially harmful weight control behaviors. This may be especially important in rural populations where smoking is highly prevalent and pregnancy outcomes are poor.

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## **THE RELATIONSHIP BETWEEN SELF-COMPASSION, SELF-CONTROL, AND PHYSICAL HEALTH**

Travis Clark and Ginette Blackhart, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Self-compassion is a topic being evaluated in contemporary psychology to determine its efficacy in describing reactions traditionally ascribed solely to self-esteem. Self-esteem is defined as the evaluation a person makes of his or her worth as a human being (Bernstein & Nash, 2008). Self-esteem is often linked directly and indirectly with mental health (Neff, 2009). Self-compassion is a construct based on Buddhist ideals of the self that includes an understanding of self-success and failure, rather than self-critique; mindfulness; and identity with fellow humans (Neff, 2003). Studies by Neff (2009) and others (e.g. Leary, et al 2007) give credit to the differences between self-esteem and self-compassion. Self-esteem highly correlates with traits such as narcissism (Baumeister, 2003), where self-compassion does not (Neff, 2009). The present correlational study uses a series of self-report measures and draws participants from the undergraduate population of a small southern Appalachian University (N=308). The study examines the relationship between self-control and self-esteem using the Rosenberg Self-Esteem Scale in contrast to the relationship between self-control and self-compassion as measured by the Self-Compassion Scale (Neff, 2003). We hypothesize that self-control can be more accurately predicted based on self-compassion values rather than self-esteem values. The current research also examines the link between subjective and objective measures of health with self-esteem and self-compassion. Subjective health was measured by self-report (e.g., "How would you describe your physical health?") and objective health was measured by exigent health conditions. We hypothesized that self-compassion will more accurately predict subjective physical health. Analyses suggest that self-compassion has a significant correlation with self-control, subjective physical health, and objective measures of physical health. Significant relationships were also

found between Self-esteem and self-control; smaller but still significant relationships were found between self-esteem and health. These results prompt further exploration into Self-compassion as a personality trait to determine its exact relationship to Self-esteem and other aspects of personality.

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### **BE AWARE...DRIVE WITH CARE**

Ashley Dickson, Benjamin Martin, and Chris Dula, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

According to the U.S. Department of Health and Human Services (USDHHS, 2001), motor vehicle crashes are the leading cause of serious injury in our society and are among the most costly and fatal of accidental injuries. Crashes are the leading cause of most deaths for people ages 1 to 33 (National Safety Council, 2001; USDHHS, 2001). Previous research indicates that situational variables account for much of these behaviors, but the role of many personality traits have yet to be examined, such as actively caring or conscientiousness. The objective of the current study was to examine the relationship between actively caring (based on personality scales of self-efficacy, optimism, self-esteem, belonging, and personal control) and dangerous driving behaviors (as measured by the Dula Dangerous Driving Index) and a demographic questionnaire. Roberts and Geller (1995) stated that actively caring refers to individuals caring enough about the health and safety of others to act accordingly. Actively caring has been operationally defined in past literature as people acting to benefit the safety of others (Geller, Roberts, & Gilmore, 1996). In this study, the “actively caring” concept is operationally defined as drivers acting to benefit the safety and well-being of other drivers while on the road. Previous literature states that increasing actively caring in individuals within a workplace increases the safety of the work environment by monitoring the safe and unsafe practices of coworkers and then providing constructive behavioral feedback (Geller, Roberts, & Gilmore, 1996). Perhaps the same inference can be made for roadway safety. It has been found in past literature that self-esteem, group cohesion, and optimism scores have predicted higher levels of self-reported willingness to actively care. It was hypothesized that those demonstrating higher levels of actively caring would exhibit less dangerous or aggressive driving behaviors. Participants consisted of 1,121 undergraduates recruited online via a survey system at a regional university in the southeast. Participants were awarded modest extra credit for their participation. Results indicated there was a relationship between actively caring and driving behaviors. Understanding the relationship between actively caring and dangerous driving could help understand how actively caring actions decrease aggressive driving behaviors.

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### **ON THE ROAD, AGAIN: THE EFFECTS OF ANXIETY AND ANGER ON DRIVING BEHAVIORS**

Ben W. Gibson, Benjamin Martin, & Chris S. Dula, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

In 2008, dangerous driving behaviors contributed to 1,035 deaths in Tennessee (Fatality Analysis Reporting System, U.S. Department of Transportation, 2009). It has been suggested that both anger and anxiety are related to personality disorders, hypertension, attachment styles, risk taking, and driving behavior (Schneider, Egan, Johnson, Drobney, & Julius, 1986; Warren, Huston, Egeland, & Sroufe, 1997; Dahlen, Martin, Ragan, & Kuhlman, 2004). For example, a recent study by Stephens and Groeger (2009) revealed that drivers with levels of high anxiety drove more cautiously and drivers with high levels of anger drove more dangerously in a simulated driving course. Furthermore, research has suggested there is a positive correlation between anger and aggression as well as risky driving behavior (Titus, 2006). While the threat posed by these behaviors may be apparent, few measures exist to test this phenomenon empirically. Participants included 1,121 undergraduate students (765 female and 356 male) with the age of participants ranging from 17 to 55 ( $M=21.34$ ,  $SD=5.61$ ). Participants completed an online survey and were awarded

modest extra credit for their participation. Measures used included the State Trait Anger Expression Inventory (STAXI), the Beck Anxiety Inventory (BAI), the Propensity for Angry Driving Scale (PADS), and the Dula Dangerous Driving Index (DDDI). DDDI scores were positively correlated with BAI and STAXI scores. The BAI and STAXI also demonstrated a strong positive correlation with one another. Thus, people with higher levels anger expression and higher levels of anxiety reported engaging in dangerous driving behaviors more frequently. Results from this type of work could be used to help predict driver riskiness in new ways.

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### **LOCOMOTOR SENSITIZATION TO METHYLPHENIDATE IN RATS: SEX DIFFERENCES AND EFFECTS ON BDNF.**

Benjamin A. Hughes<sup>1</sup>, Andrew B. Hughes<sup>1</sup>, A. Brianna Sheppard<sup>1</sup>, Brooks B. Pond<sup>2</sup>, and Russell W. Brown<sup>1</sup>.

<sup>1</sup>Department of Psychology, College of Arts and Sciences

<sup>2</sup>Gatton College of Pharmacy

East Tennessee State University, Johnson City, TN

This study was designed to analyze locomotor sensitization to methylphenidate (MPH, trade name: Ritalin) in adolescent rats. MPH is the most common medication prescribed to adolescents for treatment of attention deficit-hyperactivity disorder (ADHD). Rats were habituated to a locomotor arena from postnatal days (P)30-32 and began locomotor sensitization testing on P33. Male and female rats were administered one of three doses of methylphenidate (MPH; 1, 3, or 5 mg/kg) or saline every other day through P49, for a total of nine exposures to the drug. Approximately 10 min after each injection, all animals were placed into a locomotor arena and behavioral activity was analyzed. Results showed that adolescent females administered the 5 mg/kg dose of MPH demonstrated an approximate 100% increase in locomotor activity as compared to the 5 mg/kg dose of MPH administered to males. Additionally, females administered the 5 mg/kg dose of MPH demonstrated locomotor sensitization. No other dose of MPH produced locomotor sensitization in males or females. Interestingly, the lowest dose of MPH (1 mg/kg) produced locomotor suppression in females compared to controls, whereas in males, both the 1 and 3 mg/kg of MPH produced locomotor suppression. In a second experiment, these results were replicated in female rats given the 5 mg/kg dose of MPH, and brain tissue was analyzed for the content of brain-derived neurotrophic factor (BDNF) protein, which is a neurotrophic factor that plays a major role in synaptic maintenance and connectivity. The nucleus accumbens and striatum were analyzed, which are two brain structures that play major roles in motor function and drug reinforcement. Results showed that 5 mg/kg of MPH given in adolescent females produced a significant 40% decrease of BDNF in the striatum, but did not affect BDNF levels in the nucleus accumbens. We hypothesize that this effect may be due to increases in stress levels, which have been shown to produce decreases in BDNF.

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### **EFFECTS OF PARENTING STYLES ON COLLEGE STUDENTS ADJUSTMENT**

Michael Kirtley and Dr. Alison Barton, Department of Human Development and Learning, College of Education, East Tennessee State University, Johnson City, TN

With colleges recent refocus on retention efforts due to funding incentives, examination of factors impacting students adjustment to the college experience is timely, as better adjustment is likely to increase the probability of retention. Adjustment to college may in part be predicted by the environment from which students come. Our study thus examined the potential effects of parenting styles on college students adjustment, as measured by stress and depression. We predicted a mediational model wherein depression mediates the relationship between less effective parenting styles (i.e., permissive and authoritarian) and adjustment stress. Secondarily, we conducted exploratory analyses on the relationship between college

students negative affect and poor behavioral choices for stress reduction. Participants were 290 undergraduate students (176 female), ages 18 to 21, who completed an online survey assessing perceived parenting styles, depressive symptoms, stress, and behavioral responses to stress. Students fathers parenting was found to have no significant impact on student stress and depression. Among mothers styles, permissive and authoritarian styles were significantly and positively related to adjustment stress, and only permissive mothering was positively and significantly related to depression. Only one full model supported our hypotheses: Depression significantly mediated the relationship between permissive mothering and adjustment stress. Exploratory examination of correlations indicated both depression and stress were related to poor behavioral choices for stress management (e.g., drinking, risk-taking). Our findings suggest possible implications for college student retention efforts as well as college counseling services.

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### **FAITH IN ACTION: WHAT MOTIVATES CHRISTIAN VOLUNTEERS TO SERVE**

Rachel D. Lee, Milligan College, Milligan College, TN

In the past thirty years, charitable organizations have come to rely on volunteers to perform the services they offer (Leventhal & Cnaan, 2009). These volunteers receive no monetary gain for their efforts, yet these organizations continue to have faithful contributors. According to Boezeman and Ellemers (2008), the main focus of a volunteer organization is to aid its targeted population in need of assistance. Volunteers are expected to meet this goal, with limited amounts of funding, supplies, and finite resources. Therefore, volunteers must have motivations that incline them to offer their skills, money, and time to a cause without expecting compensation. Researchers have explored this question before and have pinpointed several different incentives for volunteering. This study seeks to further this body of research by examining the motivations of volunteers for Appalachia Service Project (ASP). ASP is a Christian charitable organization which seeks to improve the housing conditions of low-income families throughout the Appalachian region. Participants will be winter session volunteers who are typically comprised of Protestant Christian adults from out of state. After their contribution of service and signing a consent form, volunteers will complete a 22-item survey on *Zoomerang* to assess their motivations for volunteering for ASP. The survey was adapted from the Volunteer Functions Inventory (VFI) designed and used by Clary, E.G., Snyder, M., Ridge, R.D., Copeland, J., Stukas, A. A., Haugen, J., et al. (1998). They use six categories in which to classify motivations: Values, Understanding, Social, Career, Protective, and Enhancement. Because the majority of the volunteers for ASP are of the Christian faith, the current study will include faith-based motivations as a category and items relating to faith on the survey. Most of the items were adapted to include the mention of ASP or to enhance the statements' clarity. For each subgroup of motivation, there are three items. Each item consists of a statement and the participants are to rate their agreement with the statement on a 5-point Likert scale, with 1 being Strongly Disagree and 5 being Strongly Agree. After the Likert items, there is an item that requests the respondent to list his or her top three reasons to serve with ASP. The volunteers will complete the survey and answer questions about their intentions to continue service with ASP. Much care will be taken to maintain the respondents' confidentiality, and the survey will be completely voluntary. Data from the surveys will only be viewed by researchers, and all of the data should be compiled in March. Overall, this study is concerned with which motivations are most influential in a volunteer's decision to serve with ASP and the most frequently reported motivations by those who intend to serve again with ASP.

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## **DOES USE OF TEXT SPEAK IN TEXT MESSAGING AFFECT CHILDREN'S SPELLING ABILITIES? IDK, LETS C!**

Katie Murphy, Kerry Proctor-Williams, and Lindsay Pickler, Department of Communicative Disorders, College of Clinical and Rehabilitative Health Sciences, East Tennessee State University, Johnson City, TN

There has been an increased concern that a relatively new form of digital language known as “text speak” is harming children’s spelling and grammar abilities. Text speak is an abbreviated form of language that commonly consists of acronyms, the deletion of vowels, and the lack of capitalization and punctuation (Drouin & Davis, 2009). Estimates suggest that cell phone ownership among 12 to 14 years olds has rapidly climbed from an average of 32% in 2004 to 59% in 2008. Ownership also increases with age, with 2008 estimates of 51% at age 12 to 72% at age 14. Of cell phone owning teens (ages 12 to 17), 76% have sent text messages with 38% sending them daily. Overall, 58% of teens report sending a text-message, regardless of cell phone ownership (Lenhart, 2008). Considering middle school-aged children are among the top consumers in the cell phone market, the objective of this study is to determine if text speak affects the accuracy of children’s spelling and punctuation in other contexts. It is hypothesized that children who text more frequently will make more errors in both spelling and punctuation, specifically in words that are commonly abbreviated. While previous studies have failed to prove that text speak harms spelling and punctuation accuracy, this study is designed using a new approach. Instead of giving participants pre-typed conversations or passages, as many other studies have done, the participant will use a cell phone (provided by the investigator) to send actual text messages to the investigator. This study is designed to take place in three phases. In Phase 1 participants will text a total of 10 sentences to the investigator. Each sentence has been carefully composed, to have both commonly used text and non-text words at a matched spelling grade level. Sentences will be read aloud by the investigator one-at-a-time, giving the participant an ample amount of time to send each text. In Phase 2 of the study, each participant will receive a typed copy of his/her own text messages. During this phase participants will be asked to orthographically write out their own text messages, making sure to use correct spelling, grammar, and punctuation. In the final phase, Phase 3, each participant will take a standardized spelling test (Test of Written Spelling, 4<sup>th</sup> Edition) and complete a survey pertaining to cell phone and texting habits. Data will be analyzed to determine if words that children commonly use during text speak are correctly represented when prompted to use correct spelling and grammar measures. The frequency with which children use text speak will also be analyzed to determine if “high-frequency” texters make more errors than “low-frequency” texters. Correlations will be run between standardized spelling test scores and text words and non-text words. Additionally, descriptive statistics will be analyzed for demographic variables. Results and conclusions will be discussed once data has been collected.

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## **ANXIETY RECOGNITION IN RURAL PRIMARY CARE**

Spencer Oatts, Wesley Ramey, Michael Miesner, Chris Dula, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

More than half of all patients with mental disorders seek no mental health care, but approximately 80% of mental health patients will visit their primary care physician within a year (Strosahl, 1998). Kroenke et al. (2007) investigated the rate of anxiety in 15 U.S. primary care clinics. Nearly twenty percent of the patients surveyed were found to have at least one anxiety disorder, indicating that the treatment of anxiety should be considered a forefront issue in primary care. It is not well understood how to best handle anxiety cases presented in primary care practices due to a lack of research focused on anxiety in primary care. Given the high incidence of patients with anxiety disorders presented in primary care, it is important to examine how anxiety is dealt with in primary care before any advances may occur in the treatment for anxiety in primary care. Medical chart reviews of 100 randomized patients were conducted at Family Medicine Associates of Johnson City, an integrated primary care facility serving a rural Appalachian community. Preliminary analyses suggest that though anxiety is often noted in medical charts, it is rarely treated. Jameson and Blank (2007) suggest that a large problem in rural areas is a lack of communication and collaboration among primary care providers and mental health professionals. This study may improve the communication between medical and mental health professionals, eliminating any untreated diagnosis of anxiety, as well as increasing the overall healthcare of patients.

## **DISPOSITIONAL OPTIMISM AND TRAIT HOPE AS MEDIATORS OF THE RELATIONSHIP BETWEEN ETHNIC IDENTITY AND DEPRESSIVE SYMPTOMS**

Catherine Rowe, Preston Visser, M.A. and Jameson K. Hirsch, Ph.D., Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN.

Ethnic identity refers to the portion of a person's self-concept that is a compilation of knowledge, beliefs, and attitudes about affiliation, belonging and commitment to a social group of which he or she is a member. Ethnic identity may play an important role in mental and physical health functioning, and is associated with decreased depression in several ethnic groups. Although the relationship between cultural factors and depression is not completely understood, it is possible that cognitive-emotional constructs such as dispositional optimism, considered ones' general expectation of positive outcomes, or trait hope, a goal-oriented motivational characteristic, may play an important mediating role in the relationship between ethnic identity and the experience of depressive symptoms. We know of no other published data that has examined these future-oriented constructs in conjunction with ethnic identity and depressive symptoms. We assessed the potential relationship between depressive symptoms and ethnic identity as mediated through both trait hope and dispositional optimism in Blacks, Hispanics, Asians, and Whites. Participants were 366 (70% female) undergraduate students from an urban, Northeastern university, ranging in age from 18 to 46 years old ( $M = 19.56$ ;  $SD = 3.09$ ). Our sample was diverse: 42% ( $n = 154$ ) Hispanic; 25% ( $n = 93$ ) Black; 19% ( $n = 70$ ) White; 6% ( $n = 21$ ) Asian. To assess ethnic identity, we used the Multigroup Ethnic Identity Measure; for trait hope, we used the Snyder Hope Scale; for dispositional optimism, the Life Orientation Test-Revised, and for depressive symptoms, the Beck Depression Inventory-Second Edition. We used simple mediation steps outlined by Baron and Kenny (1986) to assess each of our potential mediators in separate models. Multiple mediation was assessed using a non-parametric bootstrapping procedure (Preacher & Hayes, 2008), allowing simultaneous comparison of the relative magnitude of the potential mediating effects of hope and optimism on the association between ethnic identity and depressive symptoms. In our first simple mediation, the relationship between ethnic identity and depressive symptoms remained significant but attenuated when trait hope was included in the model ( $Sobel = 4.31, p < .001$ ), indicating a partial mediation effect. Similarly, optimism partially mediated ethnic identity and depressive symptoms ( $Sobel = 4.41, p < .001$ ). In multiple mediation, we found that the direct effect of ethnic identity on depressive symptoms became non-significant with the inclusion of hope and optimism ( $t = -1.28, p = .21$ ), and both variables were significant mediators (Hope 95% CI: -.139 to -.045; Optimism 95% CI: -.187 to -.071). Our results indicate that trait hope and dispositional optimism both play a significant mediating role in the relationship between ethnic identity and depressive symptoms. Ethnic identity appears to contribute to more positive psychological functioning, which may reduce depressive symptoms. Clinical implications of this study include focusing on the promotion of ethnic identity and the encouragement of hope and optimism as potential therapeutic strategies in the reduction of depressive symptoms among diverse college students.

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### **SELF-ESTEEM AND “SEXTING”**

Brittani Sexton, Department of Psychology, Milligan College, Milligan College, TN

This research explores attitudes and the use of cell phone technology, a topic with little research thus far. Over the recent years, the use of cell phones, especially text messaging, has inclined greatly. With such advances in technology, cell phones are now capable of transferring photographs and videos via MMS (Multi Media Service), and with this particular capability, “sexting” has emerged. “Sexting” is defined as sharing naked or semi-naked pictures/videos of oneself or others and/or discussing sexual practices via mobile phones or other electronic media (Brown, Keller, & Stern, 2009). A convenience sample using the snowball technique was used to select participants via Milligan College email and Facebook. Participants were given a description of the research and a link to a survey on Zoomerang, which they voluntarily and anonymously completed. Results are discussed in light of existing research.

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## **EFFECTIVENESS OF RESIDENCY TRAINING FOR THE ASSESSMENT AND TREATMENT OF TOP BEHAVIORAL HEALTH CONCERNS IN PEDIATRIC PRIMARY CARE**

Andrew Shultz and Jodi Polaha, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Psychosocial concerns are considerably prevalent in pediatric practice, with some estimates as high as 21% of children having one or more behavioral health concerns. One of the barriers to physician management of psychosocial and related concerns in primary care is a lack of specialized training in dealing with such concerns. The aim of this research was to implement an innovative training program in a pediatric residency clinic in order to provide residents with increased awareness of frequent psychosocial concerns in primary care practice. In addition to making an onsite behavioral health consultant available to 10 of the 15 residents on staff, didactics were given to all residents on common behavioral concerns. Data were collected by research assistants by utilizing a behavioral checklist; research assistants observed 178 cases across the 15 residents. The most frequent concerns raised included feeding/eating, developmental delays, and communication problems. As a pilot study, data were inconclusive on overall effect of training for residents, but a tendency towards a significant effect is indicated by a statistical increase in frequency of behaviorally-oriented recommendations provided by physician over course of each of the three observation periods. Consequently, significance is expected from continuing data collection. In conclusion, an onsite behavioral health consultant in addition to training didactics may serve as a useful method for equipping future pediatricians with the tools required for addressing common psychosocial concerns raised in primary care settings.

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## **DRIVE ME CRAZY! THE EFFECTS OF DISTRACTING PASSENGERS ON DRIVING BEHAVIORS**

Kayla Siddell and Chris Dula, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

According to Stutts, Reinfurt, Staplin, and Rodgman (2001), motor vehicle crashes account for the greatest number of deaths amongst those between ages 3 and 34. It has been estimated that approximately one quarter of crashes reported involve some kind of driver inattention (NHTSA, 2008). According to the Fatality Analysis Reporting System (FARS), in 2008 alone, approximately 16% of all collision fatalities and 22% of injuries in motor vehicle crashes were associated with some type of driver distraction (2008). NHTSA (2002) defined distracted driving as being when a driver "is delayed in the recognition of information needed to safely accomplish the driving task because some event, activity, object, or person within or outside the vehicle compels or induces the driver's shifting attention away from the driving task." There are multitudes of distractions that can cause driver inattention. A study of drivers found that common distractions included looking at a crash or another vehicle, driver fatigue, and conversing with passengers (Crash Investigation Team, 2001). According to a survey conducted by Stutts et.al (2001), 10.9% of driver distraction was thought to be due to other occupants, and children or infants riding in vehicles caused 6% of that particular class of distraction. Drews, Pasupathi, and Strayer (2008) reported that although conversing with passengers can be dangerous, children or infants have a greater negative effect on driving abilities than other passengers. The goal of this study is to identify the impact of child and infant distraction on drivers in a simulated environment. Participants will consist of undergraduate psychology students at a rural Southeastern university. Participants assigned to the first experimental condition will be exposed to a recording of a crying infant and those assigned to the second condition will be exposed to a recording of random babbling by a toddler. Results from this study may aid in better understanding the contribution of infant and child distractions on dangerous driving behaviors.

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## **NEGATIVE LIFE EVENTS AND SUICIDAL BEHAVIOR: MODERATING ROLE OF TIME PERSPECTIVE**

A. Spence, J. P. Hatfield, B.S., A. Johnson, and J. K. Hirsch, Ph.D., Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Increased vulnerability for suicidal risk may be a result of the influence of negative and chronic stressful events. In the context of stressful and negative life events, individuals have a tendency to focus on subjective time frames in order to make sense of these negative experiences. Depending on how the individual relates to such past events, their time perspective may be predictive of suicidal activity. The concept of time perspective taps into an individual's relationship with time and the way that they work with and understand their past, present, and future. We hypothesized that all five factors would moderate the association between negative life events and suicidal behaviors with past-negative (negative view of the past), present-hedonistic (risk-taking attitude), and present-fatalistic (helpless and hopeless attitude) perspectives strengthening this association, and future (striving for future goals) and past-positive (pleasant view of the past) perspectives weakening this association. Survey responses were collected via an online data collection system at a Southeastern University, with participants receiving extra credit in a psychology course. Participants included 439 college students with a mean age of 21.02 (SD=6.11). The sample was predominantly White (91%) and female (71%). Participants completed a demographic questionnaire, the Suicidal Behaviors Questionnaire (SBQ), The Life Events Scale (LES; negative life events subscale), and Zimbardo's Time Perspective Inventory (ZTPI). Analyses included bivariate correlation, and multivariate, hierarchical linear regressions, covarying age, gender, and ethnicity. In bivariate analyses, past-negative ( $r = .34; p = .00$ ), present-fatalistic ( $r = .10; p = .01$ ), present hedonistic ( $r = -.08; p = .04$ ), future ( $r = -.13; p = .01$ ), and past-positive time perspective ( $r = -.16; p = .00$ ) were significantly associated with suicide behaviors. Negative life events were significantly associated with suicidal behaviors ( $r = .27; p = .00$ ). In independent models, past-positive time perspective was a significant moderator of the association between negative life events and suicidal behavior,  $t = -3.35, p < .01$ , Un  $\beta = -.19$  (SE=.06); a trend existed for past-negative perspective as a moderator. In a combined model, examining all subscales, past-positive time perspective remained a significant moderator,  $t = -2.30, p = .02$ , Un  $\beta = -.16$  (SE=.07). Previous research indicates that a past-positive time perspective is significantly negatively associated with, and a past-negative perspective is positively associated with, depression, anxiety, aggression, and unhappiness. Our results extend these findings to include self harm, including in the context of negative and potentially traumatic life events. For clinicians working with patients who have experienced negative life events, cognitive restructuring to promote a more adaptive temporal perspective may have utility as a suicide prevention strategy.

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## **DIFFERENTIAL HEMISPHERE ACTIVATION IN MALES AND FEMALES FOR DEDUCTIVE LOGIC USED IN SUDOKU PUZZLES EMPHASIZING DIFFERENT STIMULI.**

Ashley L. Strong, Elizabeth L. Grubbs, Lori B. Mullins, and Dr. James E. Horton, Social Sciences Department, The University of Virginia's College at Wise, Wise, VA

Researchers investigated differences in experts and novices in Sudoku puzzle solutions in males and females and their use of deductive logic and reasoning while solving Sudoku puzzles with different stimuli. The puzzles consisted of stimuli of numbers, letters and symbols in three difficulty levels. Preliminary analyses involved seven male and ten female participants. Preliminary analyses revealed a significant main effect of puzzle difficulty level  $F(2,48) = 15.816, p < .0001$  with the longer latencies from stimulus to response associated with the most difficult puzzles. There was also a significant difference in the number of errors of solutions based on the experience of the participant  $F(1,49) = 4.327, p < .043$  with the more experienced participants making less errors. Finally there was a significant difference in the number of errors due to puzzle type based on experience of the participant  $F(1,49) = 4.327, p < .043$  with the more experienced participants making less errors on the puzzles with symbols than the less experienced participants. Additionally there was a strong tendency toward a difference in latency from stimulus

presentation to response due to an interaction of puzzle type and sex with a  $p = .055$ . Additional discussion will involve correlated EEG and ERP data with sex of participants, puzzle type and experience of participants. Source analyses of EEG and ERP activity will also be presented as preliminary evidence of source generators of neural activity during deductive logic exercises and individual differences between participants.

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### **GET OUT OF MY WAY! A STUDY OF THE RELATIONSHIP BETWEEN TYPE A PERSONALITY AND DRIVING BEHAVIOR**

Shufang Sun, Ben Martin, Chris S. Dula, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Previous research has indicated that dangerous driving is correlated with personality (Arthur & Doverspike, 2001; Beirness, 1993; Burns & Wilde, 1995; Dahlen et al., 2005; Iversen & Rundmo, 2002; Jonah, 1997; Oltedal & Rundmo, 2006). Type A personality involves a sense of time urgency, competitiveness, alertness, and ambitiousness and has been linked with increased risk of coronary heart disease (Friedman & Rosenman, 1959). Studies have indicated that Type A personality was correlated with risky driving behavior but all the studies were suffered from either low sample size or complex factors (Friedman & Rosenman, 1959; Evans, Palsane & Carrere, 1987; Robert, Elander, & French, 1993). The purpose of this study was to examine the relationship between Type A personality and dangerous driving behavior, as operationalized by items on the Dula Dangerous Driving Index (DDDI; Dula & Ballard, 2003), and the relationship between Type A personality and angry driving behavior, as operationalized by items on the Propensity for Angry Driving Scale (PADS; Depaquale, et al., 2001). It was hypothesized that higher scores on a Type A personality measure would predict higher scores on the DDDI and PADS. Data has been collected via an online participant pool at a southeastern university. Participants were 1,121 college students (756 females and 365 males). The age of participants ranged from 17 to 55 ( $M=21.34$ ,  $SD=5.61$ ). The participants were awarded modest extra credit for their participation. There were significant positive correlations between Type A scores and the DDDI scores as well as with PADS total scores. Results from this study and others like it may provide additional means of assessing driver riskiness, which might have implications for insurance companies and driver education programs.

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### **WORRYING ABOUT THE FUTURE: EFFECTS OF SELF-EFFICACY AND ANXIETY ON ACADEMIC GOALS**

Desta A. Taylor, Ryne C. Druery, Dexin Shi, Benjamin Martin & Chris Dula, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Previous research has linked low levels of self-efficacy with low GPAs (Vuong, Brown-Welty, & Tracz, 2010.) Self-efficacy has been shown to have a positive influence on academic performance more than general course interest or academic goal-setting (Long et al., 2007). Bandura (1982) argued that high levels of perceived self-efficacy promote higher rates of success while performing tasks and decrease emotional arousal during tasks. He also argued that high levels of perceived self-efficacy may be responsible for improved coping skills, goal/task completion, and career pursuits. Anxiety has been linked to how individuals perceive their career goals (Jones, 1989) and poor academic performance (Hembree, 1988). Students with high levels of anxiety attain lower test scores and have poorer study habits than those with low levels of anxiety (Culler & Holahan, 1980). Furthermore, Pantel (2008) found that high self-efficacy and low generalized anxiety were accurate predictors of academic success among undergraduates. This study sought to assess the relationship that self-efficacy and anxiety may have on GPA and self-predicted academic persistence (e.g., attaining a high school diploma versus completing a college degree). Participants included 1,251 students and their parents from rural Southeastern middle schools. Data have been collected and will be analyzed presently. Results from this study may give further insight as to how

anxiety and self-efficacy may affect academic performance and perceived academic success. Furthermore, results may assist both family psychologists and school counselors in creating intervention programs to improve the performance of at-risk students. Future research should assess anxiety as a possible mediator between self-efficacy and academic success and performance.

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### **BEAT IT: THE EFFECTS OF MUSIC TYPE ON DANGEROUS DRIVING BEHAVIOR**

Jesse Thomas and Chris S. Dula, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Although many improvements to automobile safety have decreased unsafe driving practices over the years, motor vehicle crashes remain a serious public issue, and a leading cause of death in the United States (Hilton & Shankar, 2003; National Highway Traffic Safety Administration, NHTSA, 2003). In the past, NHTSA estimated that around one quarter of all crashes reported involved some form of driver inattention (Stutts, Reinfurt, Staplin, & Rodgman, 2001). Distracted driving occurs when attention is diverted away from behaviors which are critical to the safe operation of a motor vehicle (Streff & Spradlin, 2000). A survey conducted in the United Kingdom found around two-thirds of drivers listened to some form of music while driving. Automobiles have been reported as one of the most popular locations for listening to music (Dibben & Williamson, 2007). Fast tempo music has been found to affect simulated driving behaviors including speed, perceived speed estimates, and traffic violations such as running red lights, lane crossings, and collisions (Brodsky, 2001). This study evaluates driver performance in the STISIM Simulated Driving Environment under three different conditions: 1) listening to fast tempo music (170 BPM), 2) slow tempo music (54 BPM) and, 3) no music at all. It is hypothesized that participants will commit more simulated driving errors under musical conditions, particularly faster tempo music. Results from this type of work could show what effects different types of music may have on driving behaviors, as well as improve public policy concerning use of vehicular audio systems.

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### **COMPARISON OF MASCULINE AND FEMININE TRAITS IN A NATIONAL SAMPLE OF MALE AND FEMALE NURSING STUDENTS**

Kenny Thompson, L. Lee Glenn, and Daren Vertein, College of Nursing, East Tennessee State University, Johnson City, TN

The stereotype that male nurses are less masculine than other men has existed for generations and spans all age groups. This stereotype has made it difficult to attract men to the profession. Men who do choose nursing as a career, risk having their gender identity being questioned. Nursing has long been perceived as a feminine profession, suited for a woman. Several studies throughout the world have investigated masculinity and femininity characteristics of nurses using the Bem Sex-Role Inventory (BSRI) a widely used psychometric instrument with good measurement reliability and validity. No systematic investigation of masculine and feminine characteristics of men in nursing has been conducted in the United States; therefore an online survey using the BSRI was created and this study was conducted. The goal was to determine if male nursing students across the United States are less masculine than the general U.S. public. This Study also compared sex-role identity of male and female nursing students and examined the influence of independent variables on sex-role identity. To obtain nationwide responses, an advertisement was purchased in the bi-annual National Students Nurses Association's newsletter requesting willing participants to help determine if gender matters within the nursing profession. Twenty-eight male nursing and 81 females nursing students from 37 States completed the online survey. A significant difference between male and female nursing students in respect to their sex-role identity was found; Male nursing students from the current U.S. study scored significantly higher on the masculinity scale than males in a general U.S. reference population ( $p=0.012$ ). Female students scored significantly higher on the feminine scale of the BSRI than males ( $p = 0.043$ ). It was determined that the independent variables of age, region of school attending, type of degree pursuing, marital status, ethnicity, or presence of children had no

detectable influence on masculinity, femininity. The effect sizes were all below 30% ( $r = 0.30$ ) and none were statistically significant at the  $p < 0.05$  level. Based on the results of this study, it can be concluded that men entering the nursing profession display a high degree of masculinity and are not as feminine as their female counterparts. Therefore the stereotype that male nurses are less masculine than other men is rejected.

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### **ILLNESS BURDEN AND SYMPTOMS OF ANXIETY: MODERATING ROLE OF DISPOSITIONAL OPTIMISM**

J. Logan Tindell<sup>1</sup>, Kristin L. Walker, M.A.<sup>1</sup>, Josh Hatfield, B.A.<sup>1</sup>, Estill Miller<sup>1</sup>, Jeffrey Lyness, M.D.<sup>2</sup>, and Jameson K. Hirsch, Ph.D.<sup>1</sup>, <sup>1</sup>Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN; <sup>2</sup>University of Rochester Medical Center, Rochester, NY

With aging comes increased likelihood of physical illness, which may contribute to feelings of anxiety. Illness burden, comprised of multiple co-occurring medical conditions, may promote worry about future health, recovery and survival. Research indicates that older adults with greater illness burden may have an increased likelihood of poor psychological outcomes such as increased psychopathology. Psychosocial characteristics may act as buffers against such poor outcomes. One such characteristic, dispositional optimism, is defined as a generalized outcome expectancy that desired outcomes will occur or that life is generally positive, and is associated with higher levels of life satisfaction, increased subjective-well-being, better physical health, and lower levels of avoidance coping. In the context of chronic medical problems, a future-oriented sense of motivation may allow a patient to envision and move toward health-related goals, perhaps reducing feelings of distress. To the best of our knowledge, no other published research has examined the moderating role of optimism in the association of illness burden and anxiety. We hypothesized that greater levels of illness burden would be significantly positively associated with anxiety symptoms and that dispositional optimism would moderate this relationship, such that patients with illness burden who also had higher levels of optimism would report fewer anxiety symptoms. Our sample of 462 older adult primary care patients (63% female; 92% White; Mean Age = 74.9, SD = 6.53) were recruited from private and hospital-based internal medicine and family medicine primary care clinics, and completed the Hamilton Rating Scale of Depression (HAM-D), the Cumulative Illness Rating Scale (CIRS), the Snaith Clinical Anxiety Scale (SCAS), and a measure of dispositional optimism, the Life Orientation Test-Revised (LOT-R). Regression analyses were conducted to examine the potential moderating role of dispositional optimism. Supporting our hypothesis, physician-rated cumulative illness burden was significantly positively associated with a higher level of anxiety, and dispositional optimism moderated this relationship. Individuals with higher levels of optimism reported less anxiety in the presence of illness burden when anxiety was assessed via the Snaith Clinical Anxiety Scale Total Score,  $t = -2.75$ ,  $p < .01$ ,  $\text{Un } \beta = -.03$  [ $\text{SE} = .01$ ], and when assessed using the HAMD Psychic Anxiety Item,  $t = -2.49$ ,  $p < .05$ ,  $\text{Un } \beta = -.01$  [ $\text{SE} = .001$ ]. Dispositional optimism mitigates the association of illness burden and symptoms of anxiety. Our results contribute to the literature on anxiety and illness burden and emphasize the protective role of dispositional optimism for older adults. Limitations of our study include a lack of diversity and use of cross-sectional data. Our results may have implications for the use of therapeutic interventions that aim to increase optimism, to reduce anxiety symptoms, and to improve quality of life.

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### **CONSIDER THIS: THE RELATIONSHIP BETWEEN CONSCIENTIOUSNESS AND DANGEROUS DRIVING BEHAVIORS**

Jiaju Wu, Benjamin Martin, and Chris Dula, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

In the United States, every year, approximately 1.8 million car crashes are caused by dangerous driving behaviors (Nerenberg, 1997). According to Dahlen and White (2006), conscientiousness, one of the “Big Five” personality traits, is related to driving behaviors. In a previous study of 477 people, researchers found that individuals who are more responsible and dependable are less likely to be in car accidents than less

responsible and dependable people (Arthur & Graziano, 1996). Drivers with higher levels of conscientiousness display greater concern for others' well-being and safety. While there are many causes for traffic accidents, dangerous driving behaviors play an important role. The purpose of this study was to examine the relationship between conscientiousness, propensity for angry driving, as well as three aspects of dangerous driving behaviors, as defined by the Dula Dangerous Driving Index (DDDI). Specifically, these include aggressive driving, negative emotional driving, and risky driving. It was hypothesized that higher conscientiousness scores would predict lower scores on the DDDI total. Data were collected via an online participant pool at a southeastern university. Participants were 1,121 undergraduate students (765 female and 356 male) and the age of participants ranged from 17 to 55 ( $M=21.34$ ,  $SD=5.61$ ). Participants were awarded modest extra credit for their participation. The results showed that Conscientiousness scores were all negatively related to PADS and all DDDI subscales as well as the DDDI total score. The results from this study suggest that future work in this area might lead to new ways for insurance companies to assess driver risk and determine premiums, or for tailoring driver education programs.

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### **MENTAL HEALTH SEEKING AND RELATED STIGMA OF INTERNATIONAL STUDENTS AT ETSU**

Wanze Xie, Jeffrey Ellison, Dr. Jodi Polaha, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

**Background.** Mori (2000) put forward evidence that international students were at greater risk for psychological problems. He also said that mental health concerns of international students on American campuses were often overlooked. Stigma associated with mental illness and seeking treatment is the reason most often cited that people do not seek counseling and other mental health services (Corrigan, 2004). No studies have focused on international students' beliefs about service seeking or stigma around health treatment seeking. **Objective.** The basic aims of this study are to examine international students' beliefs about mental health services and relationships between stigma and mental health treatment seeking.

**Method.** Participants are 35 international students who were invited to fill out an online questionnaire. The measures included in the questionnaire were designed to collect demographic information (i.e. sex, age, country of birth, etc.), students' perceived stigma regarding help seeking (i.e. social stigma), students' overall distress level, students' prior treatment seeking and willingness to seek treatment from various people (i.e. family/friends, psychologists, teachers, doctors, etc.), and students' willingness to seek treatment from a psychologist in various settings (i.e. Community clinic, private practice, primary care, etc.). **Results.** International students at ETSU generally reported feeling moderate levels of stigma regarding mental health treatment [ $M=2.02$ ,  $SD=.466$ ,  $N=36$  (1= little/no experienced stigma and 4 = extremely high levels of experienced stigma)]. Additionally, they reported being equally as likely to seek help from others as to deal with their troubles on their own ( $M=2.47$ ,  $SD=.416$ ,  $N=34$ ). Among the students who hadn't talked with family members/close friends, doctors, or psychologists about their problems, the more stigma that they felt, the less willing that they were to talk with family members/close friends, doctors, or psychologists in the future ( $r=-.474$ ,  $p<.05$ ,  $N=19$ ;  $r=-.503$ ,  $p<.01$ ,  $N=27$ ;  $r=-.689$ ,  $p<.001$ ,  $N=27$ ). Among all international students, the more stigma they felt, the less willing that they were to seek treatment from a psychologist (counselor or therapist) working at their school or community behavior and health center ( $r=-.39$ ,  $p<.05$ ,  $N=30$ ;  $r=-.415$ ,  $p<.05$ ,  $N=31$ ). However, stigma was not found to be significantly correlated with treatment seeking from a psychologist working in any other setting (ie. private practice or doctors' office). **Implications.** Even though the results show that international students generally only feel a moderate amount of stigma, the stigma that they do experience significantly influences their willingness to seek mental health treatment. Future research should focus on identifying new ways addressing this major barrier to mental health treatment seeking to hopefully increase mental health service utilization by international student on college campuses.

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# Division II – Graduate Students

## 1~2 Years

### Arts & Humanities and Biomedical Sciences

#### **CHARACTERIZATION OF CHLAMYDIAL GROWTH AND INDUCTION OF PERSISTENCE IN A MURINE OVIDUCT EPITHELIAL CELL LINE**

Regenia B. Phillips Campbell, Jennifer Kintner, Robert V. Schoborg, Department of Microbiology, College of Medicine, East Tennessee State University, Johnson City, TN

*Chlamydia trachomatis* is the most common bacterial sexually transmitted disease agent worldwide. It is known as the silent epidemic because many patients are asymptomatic; this can result in serious reproductive complications. Chlamydia exist in two forms- i) the elementary body (EB), which can infect a cell but is non-replicative, and ii) the reticulate body (RB), which can replicate but is not infectious. After attachment to an epithelial cell surface, EB are internalized by receptor-mediated endocytosis. Vacuoles containing EB fuse to form an inclusion, a membrane-bound structure in which EB transform to RB. RB require host cell metabolites and divide by binary fission. After multiple rounds of division, RB condense to form intermediate bodies and then infectious EB, which are released to infect new host cells. In culture, environmental stressors such as nutrient deprivation and penicillin exposure induce the bacteria to enter a viable but non-infectious state termed persistence. Notably, persistent organisms can reenter the normal developmental cycle after the stressor is removed. Persistent chlamydiae are also more resistant to anti-chlamydial drugs. Indirect evidence suggests that chlamydiae enter persistence *in vivo*, but the role of persistence in chlamydial pathogenesis is unknown. Our goal is to develop an animal model of persistent infection in which we can determine the role of persistent chlamydiae in disease. *Chlamydia muridarum* is more than 99% genetically identical to *C. trachomatis* and produces an essentially identical disease in mice; therefore, we hypothesize that *C. muridarum* may be a useful organism with which to develop a murine persistence model. Initially, BM1.11 murine oviduct epithelial cells were infected with *C. muridarum* with samples taken periodically for infectious titer determination and electron microscopy to determine the organisms growth characteristics. These data verified that *C. muridarum* requires approximately 8 to 12 hours (h) to form inclusions but only 40 h to complete a growth cycle, substantially quicker than observed for *C. trachomatis*. Later experiments verified that: i) amoxicillin (Amox) exposure induced *C. muridarum* Weiss to enter a persistent state within BM1.11 cells, ii) chlamydiae recover from persistence after Amox removal, and iii) the chlamydiae should be Amox exposed at 8 h post infection in future experiments. Thus, we conclude that *Chlamydia muridarum* Weiss is appropriate for use in developing an *in vivo* murine persistence model and that Amox-exposure is an appropriate means by which to induce *C. muridarum* Weiss persistent infection *in vivo*. Development of this animal model will ultimately allow us to determine how persistent infection affects pathogenesis, transmission, and antimicrobial therapy.

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#### **VITAMIN D AND IMMUNOREGULATION EFFECT ON INFLAMMATORY RESPONSES**

Vijay Damarla, Mariah Pate, Sarah Wilgenbush, Kenton Hall, Kathy Whalen, Nikhil Holla, Karthik Venkataraman, Udayasankar Kumaraguru Ph.D., David S. Chi Ph.D., Ronald Hamdy M.D., and Guha Krishnaswamy M.D., Department of Internal Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

In recent years, Vitamin D has been identified as having effects far beyond calcium and bone metabolism which includes its effect on immune system, particularly on T-cell mediated immunity. Animal models of experimental autoimmune diseases like autoimmune encephalomyelitis, systemic lupus erythematosus, type I diabetes, rheumatoid arthritis, metastatic breast cancer, inflammatory bowel disease have been prevented

or markedly suppressed with vitamin D. New and emerging literature documents evidence of vitamin D deficiency association with other diseases like asthma, hypertension, anemia, hypothyroidism, respiratory infections, preeclampsia, malignancy and death from variety of causes. Possible mechanism of suppression of autoimmune diseases by vitamin D is due to stimulation of transforming growth factor (TGF- $\beta$ ) and IL-4 production, which in turn, may suppress inflammatory T cell activity. Patients from the VA osteoporosis clinic, ages 40-85, were selected for this study with either normal vitamin D value ( $>$  or = 35 ng/mL), insufficiency ( $<$  35 -10 ng/mL), or deficiency ( $<$ 10 ng/mL). Routine tests done at the clinic include 25(OH) and 1, 25(OH) 2 D3 levels, PTH, ESR, CRP, SPEP, TSH, CBC and DC. Lymphocytes were then separated from the blood samples, cultured and activated with PHA in vitro. Cell free supernatants were assayed for specific cytokines by ELISA. Patients enrolled will undergo vitamin D replacement and above tests will be repeated at 3 and 6 months in both deficient and control populations. Clinical laboratory results available from the patient records were reviewed and analyzed. In controls (group I) Mean values of Vitamin D, Calcium, ESR, CRP levels, T score of Right femoral neck (RFN) are 41.0, 9.6, 13.57, 15.64, -2.033 with a Standard deviation (S.D.) of 3.703, 0.385, 10.03, 17.10, 0.668 respectively. In the Vitamin D insufficient (group III) Mean values of Vitamin D, Calcium, ESR, CRP levels, T score of RFN are 23.5, 9.53, 15.0, 7.283, -2.217 with a S.D. of 2.168, 0.638, 16.95, 1.579, 0.983 respectively. Mean values of IL-6 (unstimulated) in group I & III are 23.629 and 112.056 with a S.D. of 12.998 and 151.299 while mean values of IL-6 (stimulated) in group I and III are 4141.198 and 2961.365 with a S.D. of 3815.647 and 2119.633 respectively. Analysis of data obtained from study participants who are vitamin D insufficient reveals low calcium, increased ESR, low CRP and low T score of RFN compared to controls at the starting of the study. We see a trend but the inclusion of more patients as the study progresses might improve the strength and significance of the observations. Evaluation of Immune profile in all groups in all groups of study population before and after replenishing with Vitamin D at the end of the study may substantiate the role of vitamin D in the regulation of immune system and provide a potential area of research that may lead to new therapies.

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### **A GENETIC SCREEN TO IDENTIFY GENES IN C. ALBICANS THAT ARE INVOLVED IN CROSS-SPECIES INTERACTIONS**

Sean Fox and Michael Kruppa, Department of Microbiology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Polymicrobial interactions with the dimorphic fungus *Candida albicans* is a relatively new area of study. Several studies have documented *C. albicans* interactions with a number of bacteria, including *Staphylococcus* and *Pseudomonas*. Primarily these studies have focused on the role that quorum sensing plays in dictating *C. albicans* ability to filament in the presence of bacteria. In this current study, we have taken a genetic approach to characterize the genes that are involved in regulating *C. albicans* filamentation activity in the presence of different bacterial species. We hypothesize that *C. albicans* utilizes more than one pathway to regulate filamentation in the presence of bacteria. To address this, we have performed a genetic screen using a library of haploinsufficient mutants, generated by transposon insertion, to identify potential genes that are important for regulating *C. albicans* morphogenic response via interaction with bacterial species. Briefly, the screen consisted of spotting *C. albicans* onto lawns of *S. aureus*, *E. coli*, and *P. aeruginosa*, which normally inhibit *Candida* filamentation, and monitoring for mutants that filamented after a period of seven days. We have screened over 11,000 mutants from a total of 18,141 by this method. Of the 11,000 screened, 381 were identified as exhibiting filamentation in the presence of bacteria and were not hyperfilamentous. From the 381 strains identified, 110 filamented in the presence of all three bacteria, 159 displayed filamentation in the presence of individual bacteria and 112 strains differed by filamenting in the presence of two of three bacterial species. To identify the insertion mutation sites, we have sequenced DNA from several of the mutants and mapped the insertion sites by BLAST analysis of the *C. albicans* genome. We observed four types of insertion events: 1) within a promoter of a gene, 2) within a divergent promoter, 3) within a gene, and 4) in a non-coding functional region of the genome. Genes that were identified fell into different classes including transcriptional regulators, transport genes, signal transduction, and cell wall adherence. However many have no defined function. The results indicate that *C. albicans* has several genes related to interaction with specific bacteria and some that are common for interaction with all three species tested. The differences in the genetic requirements may be related to the molecules bacteria

secrete such as quorum sensing molecules, antibiotics or other metabolites that *C. albicans* must recognize and respond within these polymicrobial communities. Characterizing the genes behind these interactions will help define the mechanisms of Candida-bacterial interactions and serve in the identification of potentially new targets for antimicrobial development.

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### **ANALYSIS OF VARIOUS PERFORMANCE CHARACTERISTICS OVER TIME IN NCAA DIVISION I VOLLEYBALL PLAYERS**

A.A. Kavanaugh, B. Jennings, C.D. Plourd, M.E. Stone, M.W. Ramsey, and M.H. Stone  
Center of Excellence for Sport Science and Coach Education, Sports Science Laboratory, East Tennessee State University, Johnson City, TN

Volleyball is a sport determined primarily by peak force (PF), rate of force development (RFD), power output, and favorable body composition. Monitoring these characteristics over time can help the coaching staff determine the effectiveness of training, as well as to ensure the success and development of an athlete's potential. The following study analyzed the performance variables of seven Division I female volleyball players (returners) over the course of two years (8 testing sessions). Total team values were also analyzed for trends. The tests included body composition (BdM and %BF), vertical jumps (JH & PP), isometric mid-thigh pulls (IPF, PF@50, 90, 250 m/s, RFD, and allometrically scaled variables) and agility. Two-tailed, two-sample unequal variance T-Tests were used to determine statistical significance ( $p \leq 0.05$ ) and Pearson correlations were used to determine relationships between variables. Statistical significance of returners IPFa occurred from August 2007 testing to September 2008, April 2009 and August 2009. RFD also improved significantly from August 2007 to January 2009, April 2009 and August 2009. Similarly, the returners had the greatest increases in SJ, CMJ, and power outputs in August 2009 as compared to August 2007, with almost all variables showing significance increases. In addition moderate to strong correlations were reported between IPFa and almost all the performance characteristics for both the team and returners. Consequentially, the data over time suggests that strength (IPF and IPFa) is a major determinant in explosive movements such as jumping and cutting performed in volleyball. It also indicates that implementing a yearly strength training program will significantly increase major performance variables essential for athletic success.

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### **MOSAIC ANALYSIS WITH DOUBLE MARKERS (MADM) AS A METHOD TO MAP CELL FATES IN ADULT MOUSE TASTE BUDS**

Preston D. Moore, Jarrod Sword, Dennis M. Defoe, and Theresa A. Harrison, Department of Anatomy and Cell Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Unlike most other sensory organs, taste buds undergo continual cell turnover during development as well as throughout life. However, while the overall process has been known for nearly fifty years, the detailed events leading from progenitor cell proliferation to differentiation of functional subtypes of taste cells are not yet clearly understood. In the present study, we have applied a new fate mapping technique to trace taste cell regeneration at single-cell resolution in the circumvallate papillae (CVP) of normal mice. The MADM technique provides an efficient approach to visualize clonal cell populations and map their lineage pathways through the use of Cre/LoxP-dependent *interchromosomal* mitotic recombination. To set up an experiment, a Cre recombinase-expressing mouse line was interbred with two reporter strains in which reciprocally chimeric marker genes are separately "knocked-in" at the *ROSA26* loci located on each of the respective chromosomes 6. The chimeric marker genes consist of partial coding sequences for green and red fluorescent proteins (GFP and RFP, respectively) separated by an intron containing the loxP site. When combined Cre-mediated recombination and post-transcriptional modifications take place, a relatively rare event, the resultant intron splicing produces reconstitution of functional green and red fluorescent proteins. Upon G2-X segregation at the end of the mitotic cycle, each progeny cell and all its subsequent

descendents become labeled by expression of either GFP or RFP, but not both. Animals of the appropriate MADM genotype were identified by PCR, sacrificed by carbon dioxide asphyxiation and their CVP extracted surgically. Serial 25 $\mu$ m frozen sections of parformaldehyde-fixed CVP were then obtained via cryostat sectioning, and cells containing GFP and RFP were visualized at 1 $\mu$ m intervals using confocal fluorescence microscopy. To date, we have examined CVP taste buds in mice resulting from crosses with two Cre-expressing lines, Hprt-Cre (Cre ubiquitously expressed) and Krt14-Cre (Cre expression targeted to epithelial progenitor cells). In each case, sparse, discreet, and well separated groups of labeled cells are evident both in the CVP and lingual epithelium. Within the CVP, groups of elongate taste cells within buds, as well as cells associated with the taste pore, were represented in these putative clones. In the lingual surface epithelium, stacks of ovoid cells spanning the full thickness of the stratified epithelium are seen. Little intermixing of cells in these two respective populations is seen. Our results indicate that the MADM approach is an effective method of following the process of taste cell generation and turnover during their lineage throughout the taste buds.

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### **ANTINEOPLASTIC ACTIVITY OF FLAVONOID ISOMERS A AND B**

Jarrett Wyatt, Christian Thomas, and Robert Wood, Gatton College of Pharmacy, East Tennessee State University, Johnson City, TN

Etnobotany studies have long indicated the anticancer therapeutic value of certain plants that belong to the genus Achyrocline, family Compositae. We are interested in an Achyrocline species indigenous to the Andean region of South America. This plant grows in cold climates with dry soils and has successfully undergone preliminary domestication studies. This study presents the preliminary results of anticancer activity studies on cancer cell lines MCF-7 (breast), PC-3 (prostate), Caco-2 (colon adenocarcinoma), MIA PaCa (pancreas carcinoma) and Panc 28 (pancreas adenocarcinoma). Our data indicate that flavones A and B exhibit strong apoptotic activity on human colon adenocarcinoma Caco-2 cells, pancreatic adenocarcinoma Panc28 cells, and pancreatic carcinoma MIA PaCa cells; but not on MCF-7 or PC3 cell lines. These compounds may have the potential to offer a novel therapeutic approach to colon or pancreatic cancer patients.

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## **Natural Sciences & Mathematics**

### **GENERATING COMPACT WASP NEST STRUCTURES VIA MINIMAL COMPLEXITY ALGORITHMS**

Fadel Adoe<sup>1</sup>, Istvan Karsai<sup>2</sup> and Chris Wallace<sup>1</sup>, <sup>1</sup>Department of Computer Science; College of Business and Technology, <sup>2</sup>Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Self organization is a process in which a pattern emerges at the global level of a system solely from numerous interactions among lower-level components of the system. One example is how wasps individually yet cooperatively build a comb from hexagonal cells. However, the underlying behavior that facilitates the emergence of this global pattern is not generally well understood. Our study focuses on different low complexity building algorithms and characterizes how nests are built using these simple building algorithms. In this model, the nest is first initiated with a single hexagonal cell and then six neighbors that correspond to the sides of the cell are generated and stored as potential building cells (domain cells) of the emerging nest. The next cell added to the nest is picked from the domain cells. The cell picking process is based on rules that are believed to be functions of wasps' building behavior. Three rules were developed. First, the random rule, in which there is no constraint per the choice of site to be

initiated. All sites have equal chance. The second is the 2-cell rule. With the 2-cell rule, only sites with at least two ready walls or neighbors are initiated. Third, the maxWall rule, which ensures only sites with the maximum number of ready walls are initiated. Generally, the choice of a particular site among other sites that obey a particular rule is random. Neighbors are generated and stored for the new added cell. This process of picking, generating and storing neighbor cells is done recursively until a predetermined nest size is reached. With this approach we simulate the building scripts, where the wasps have no global information on the nest. With this approach, various global structures emerge of which the centre of mass, eccentricity and compatibility are calculated. These calculated parameters are used as feedback to optimize the rules. With the same number of simulations, the 2-cell rule was found to generate more life-like and compact structures than the random rule, while the maxWall rule generated the most life-like and highly compact structures. This work will provide better insight and visualization through simulation into wasps building behavior and organization. This acquired knowledge can be applied to collective robots, evolutionary design, self-assembly robots, distributed optimization processes and the business industry.

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### **SCREENING THE SOIL BACTERIUM *RHODOCOCCUS* FOR ANTIBIOTIC PRODUCERS**

Tom Barber and Bert Lampson, Department of Health Sciences, College of Public Health, East Tennessee State University, Johnson City, TN

Many important antibiotics have become nearly obsolete due to the rise of antibiotic resistant pathogens. This has caused a revival of the classical method of screening soil microbes for antibiotic producers. *Rhodococcus*, a relative of the prolific antibiotic producer *Streptomyces*, contains numerous genes involved in secondary metabolism (24 non-ribosomal peptide synthases, 7 polyketide synthases). This suggests that they may also produce antibiotics. To test this hypothesis, new strains of *Rhodococcus* were isolated from different soils around East Tennessee and other regions around the world. Enrichment culturing was carried out to isolate rare strains of *Rhodococcus* that can grow on hexadecane and trichloroethylene as the sole source of carbon and energy from contaminated soils. For 'clean' soils other methods were employed, such as rigorous heat shock of the soil sample before plating. Pigmented colonies with Gram (+) rods were further identified by 16S rRNA sequencing. New strains of *Rhodococcus* were quick-screened for antibiotic production using an agar-plug method. More in-depth screening was conducted by growing each strain in a shake flask culture containing Amberlite XAD resin. Hydrophobic compounds bound to the resin were extracted with methanol. The crude extract was tested in a bioassay against three indicator strains (*Micrococcus luteus*, *E. coli*, and *Rhodococcus erythropolis*). Currently 2 isolates have been found to produce compounds with bioactivity: isolate EHC2, which inhibits growth of *M. luteus*, and isolate KCHXW3, with activity against *E. coli*. Currently efforts are underway to scale up production of these compounds for purification and characterization.

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### **EFFECTS OF HABITAT CHANGE ON PLETHODON WELLERI IN THE SOUTHERN APPALACHIAN MOUNTAINS**

Kirsten Borger and Istvan Karsai, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Fires are both a natural and manmade occurrence in forested areas. Management Agencies perform prescribed burns in forested areas to minimize the damage of a natural fire. Both prescribed and natural fires cause changes both directly and indirectly to the ecosystem. Vegetation will change from direct influences of the fire, while organisms including *P. welleri* are indirectly influenced by fire. In densely forested areas fire will cause a larger amount of damage due to the abundance of fuel. This also results in less area suitable for organisms including *P. welleri* to live. In less dense areas the results of the fire are

less dramatic on the ecosystem. The forest may become fragmented, which provides areas that are suitable for *P. welleri* to retreat from burned areas. Through modeling the dynamics of tree-salamander-fire dynamics of a mountain, we show how fire will affect the population of *P. welleri*. We show that even if the fires are local and small it can have serious effect on the population in the long term.

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### **ROLE OF $\alpha$ -VISIT-DG SEQUENCE RESIDUES IN THE CATALYTIC SITES OF *ESCHERICHIA COLI* ATP SYNTHASE**

Laura Brudecki, Chao Zhao, and Zulfiqar Ahmad, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

$F_1F_o$ ATP synthase is the primary source of cellular energy production in animals, plants, and all microorganisms. ATP synthase is also the smallest known biological nanomotor. This has brought it to the forefront of nanomedicine, an offshoot of nanotechnology. Malfunction of this enzyme is not only implicated in diseases such as cancer, Parkinson's disease, Alzheimer's, hypertension, neuropathy, but it is also a molecular target for the treatment of many diseases. There are many functional motifs in and around the catalytic sites of ATP synthase. One of them is the highly conserved  $\alpha$ -subunit VISIT-DG sequence which is in close proximity to the phosphate-binding subdomain. The questions arise: "What role(s) do VISIT-DG residues have? Are they functionally important, and if so, are they involved in Pi binding directly or indirectly? Or are they there simply for the structural integrity of the catalytic site?" Exploring the molecular basis of Pi binding is an important way to examine and understand the functional role of residues within the catalytic site. Thus, we embarked on the mutagenic analysis of VISIT-DG residues. Each residue was changed to A/R/D/Q. Here we will discuss three important residues:  $\alpha$ Ile-346,  $\alpha$ Ile-348, and  $\alpha$ Thr-349. Some double mutations were also made in order to understand the communication between the VISIT-DG sequence residues and previously known Pi binding residues such as  $\beta$ Arg-182,  $\alpha$ Arg-376, and  $\beta$ Arg-246. Growth assays in limiting glucose and on succinate plates suggest  $\alpha$ Ile-346,  $\alpha$ Ile-348, and  $\alpha$ Thr-349 are critical for normal enzymatic function (oxidative phosphorylation). Our initial biochemical assays do suggest a role in Pi binding. Direct or indirect involvement is yet to be elucidated.

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### **DIFFERENTIAL INHIBITION OF *Escherichia coli* ATP SYNTHASE BY DIETARY BIOFLAVONOIDS.**

Nagababu Chinnam and Zulfiqar Ahmad, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

ATP synthase is the functional means of the cellular energy production in all organisms. Malfunction of ATP synthase is associated with multiple disease conditions such as cancer, cystic fibrosis, Alzheimers, Parkinsons. This enzyme is not only implicated to many disease conditions but is likely to contribute to new therapies for multiple diseases by being a decent molecular target for natural or synthetic inhibitors such as polyphenols or bioflavonoids. Bioflavonoids/polyphenols are a class of plant secondary metabolites known to exhibit antioxidants, chemopreventive, and chemotherapeutic properties. They have also been shown to have anti-allergic, anti-inflammatory, and anti-microbial activity. Their actual mode of action is not clear, but some dietary bioflavonoids are known to block the action of enzymes and other substances that promote the growth of cancer cells by binding to the multiple molecular targets in the body including ATP synthase. For example one of the most common dietary polyphenol resveratrol has been shown to have anticancer/ antitumor effects, and antimicrobial activities. Resveratrol was also shown to induce apoptosis via mitochondrial pathways and has chemopreventive properties against prostate cancer. Here we will discuss the general inhibitory effects of dietary bioflavonoids on ATP synthase enzyme and intact *E. coli* cells.

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## **IDENTIFICATION AND CHARACTERIZATION OF SABP2 INTERACTING PROTEINS**

LaTonya Gillespie and Dhirendra Kumar, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Salicylic acid (SA) plays a significant role in plant growth, development and disease resistance. SA-mediated defense signaling pathway is the major pathway in plants exhibiting microbial defense. SABP2 is recognized as a low abundance soluble protein that exhibits high affinity for SA. RNAi-mediated silencing of SABP2 renders plants more susceptible to viral and bacterial plant pathogens. Biochemically, SABP2 is an esterase which catalyzes the conversion of methyl salicylic acid (MeSA) into SA, which triggers both local and systemic acquired resistance (SAR). MeSA serves as a phloem mobile signal which moves to other uninfected distal parts of the plant where it is converted into SA by SABP2. High levels of SA, is lethal for cells. Increased levels of SA in the cell, inhibits esterase activity of SABP2. We hypothesize that SABP2 interacts with other plant proteins which help control its activity to mediate the disease resistance. To identify SABP2-interacting proteins we are using yeast-two hybrid screen. The yeast two-hybrid system is devised to identify genes encoding proteins that are physically associated with a SABP2 protein *in vivo*. We created the bait plasmid construct using the SABP2 coding region and the DNA binding domain of Gal4 yeast transcription factor protein. This SABP2 bait was used to transform a yeast strain lacking the promoter for the reporter genes. A library of expressed tobacco genes (prey library) was created by fusing with activation domain (AD) of GAL4 transcription factor. Library was transformed into another strain of yeast. For screening, bait and library containing yeast was mated and diploid yeast were selected on SD/-Leu/-Trp media. SABP2 positive interactors were selected by using X- $\alpha$ -gal (gives blue color) and Aureobasidin A (antibiotic selection) in the media. Several putative SABP2 interacting proteins have been identified by patching these colonies onto more stringent SD/-Ade/-His/-Leu/-Trp containing X- $\alpha$ -gal and Aureobasidin A. We are currently isolating the plasmids from these positive interactors which will be used for further validation using *in-vivo* interactions and biochemical interactions. Validated clones will be sequenced, searched for similar known proteins using BLAST analysis and characterized for their role in SA-mediated disease resistance signaling. This work will be useful in understanding the role of SABP2 and its interactors. Understanding the biochemical role of these proteins can lead to the development of novel plant defense elicitors thereby reducing our dependence on pesticides.

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### **DOES SABP2 EXIST AS A DIMER IN PLANTS?**

Mir Hossain and Dhirendra Kumar, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Salicylic acid (SA) is an important signal molecule in tobacco plant, which induces downstream defense response to activate the systemic acquired resistance (SAR) to plant pathogens. Salicylic acid binding protein 2 (SABP2) is one of the key enzymes in SA pathway, which converts methyl salicylate (MeSA) into SA. SABP2 is a 29 Kd protein, extremely low abundance in plant and is a member of  $\alpha/\beta$  hydrolase super family which has both esterase and lipase activity. Although, it has been shown that over expressed 6x His-tagged SABP2 in *E. coli* is a homodimer, but its exact conformation in *planta* is still unknown. Therefore, we proposed several biochemical approaches to identify SABP2 dimer in plant. 6x His-tagged SABP2 were over expressed in *E. coli* and was purified using Ni-NTA affinity column. The proteins were separated on both SDS-PAGE and native-PAGE; western blots were performed using SABP2 antibody. SABP2 dimers were found only in native-PAGE, showing the denaturing effect of SDS on SABP2 dimer. In a similar experiment, proteins from Arabidopsis plants over expressing 6x-myc-tagged SABP2 were separated on SDS-PAGE and western blot was performed using myc-antibody. The result showed monomer but no dimer, suggesting the denaturing effect of SDS. To find out an effective method to detect SABP2 dimer in plant, several experiments are in progress, including purification of SABP2 from tobacco plant, both in natural and over expressed condition. To verify the effect of plant produced reactive oxygen intermediates (ROIs) upon infection, tobacco plants will be infected by tobacco mosaic virus (TMV) and

protein extracts will be run on native-PAGE followed by western blot using SABP2 antibody. If any SABP2 dimer is found then ion-exchange and gel filtration chromatography will be used to separate the dimer from the monomer. To verify the activity of SABP2 dimer an enzyme assay will be performed using MeSA as a substrate while SA will be the expected product. On the other hand, SABP2 monomers will be treated with chemical cross linking agents to see if these cross linkers can induce dimer formation, which will help to understand the chemical bond formation in SABP2 dimer. Studies on SABP2 conformation in normal and disease condition will give us insight to the structure and function of this protein in SA pathway.

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### **HERMIT THRUSH (*CATHARUS GUTTATUS*) AND VEERY (*C. FUSCESCENS*) HABITAT ASSOCIATIONS IN SOUTHERN APPALACHIAN HIGH-ELEVATION FORESTS**

Andrew J. Laughlin, Dr. Fred J. Alsop, Dr. Istvan Karsai, and Dr. Thomas Laughlin, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

The Hermit Thrush and Veery are closely related migratory songbirds that breed across much of North America and Canada. Over the last 40 years, the Hermit Thrush has been expanding its range south along the high-elevation peaks of the Appalachian Mountains. This southward range expansion is noteworthy, because it goes against the models of a northward avian range expansion predicted and verified by many climate studies. In order to understand why this species is expanding its breeding range into Tennessee and North Carolina, and also to gain more information about the local breeding ecology of this newly arrived bird, numerous topographical and habitat variables were measured and calculated in 30 Hermit Thrush and 24 Veery territories. These measurements were compared using multivariate analyses, and distinguished using Principal Components Analysis. Several differences between these species habitat preferences were discovered. Hermit Thrushes preferred territories with higher percent canopy closure, more leaf litter on the ground, and much less shrub density than Veeries. These differences match well with what is known about these species breeding and foraging ecologies. Hermit Thrushes forage for insects on the ground more than Veeries, and Veeries prefer to nest in thick shrubs. This is the first study to compare Hermit Thrush and Veery habitat preferences in east Tennessee, and also allowed the first description of the preferred habitat of a new Tennessee breeding bird.

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### **NEUROCHEMICAL UNDERPINNINGS OF BEHAVIOR AND SOCIAL STRUCTURE IN THE NORTHERN SOCIAL SPIDER, *ANELOSIMUS STUDIOSUS***

Jennifer B. Price<sup>1</sup>, Thomas C. Jones<sup>1</sup>, David S. Roane<sup>2</sup>  
<sup>1</sup>Department of Biological Sciences, College of Arts and Sciences,  
<sup>2</sup>College of Pharmacy,  
East Tennessee State University, Johnson City, TN

Populations of the cooperative spider, *Anelosimus studiosus*, in eastern Tennessee exhibit both social and solitary colonies, and individual spiders can be classified into social/tolerant or solitary/aggressive phenotypes. The striking differences lead to questions regarding the physiological differences which may underlie aggression and social behavior in these spiders. Octopamine is a neurochemical commonly thought of as the invertebrate counterpart of norepinephrine. It acts as a neurotransmitter, neuromodulator, and neurohormone. Previous studies have found that octopamine increases aggression in several invertebrate species. We hypothesize that the behavioral differences in *A. studiosus* are correlated with octopamine levels. Using HPLC-ECD (High Pressure Liquid Chromatography-Electrochemical Detection), we have quantified levels of octopamine in whole-spider extractions. Among spiders collected from social and solitary colonies from two different populations, we detected relatively higher levels of octopamine in the solitary spiders.

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## **ENVIRONMENTAL CONCERNS OF NANOPARTICLES IN WASTE WATER TREATMENT PLANT**

T. U. Silva, Department of Environmental Health, College of Public Health, East Tennessee State University, Johnson City, TN

Nanotechnology is a rapidly developing technology that allows creating products with better performance, quality in cheap methods than existing products. Nanomaterial is defined as any compound with at least one dimension less than 100nm. The properties of nanoparticles vary greatly with its bulk materials due to surface area to volume ratio, size and quantum effects. The literature review concisely describes the fate and environmental concerns of  $\text{TiO}_2$  nanoparticles in waster water treatment plant.  $\text{TiO}_2$  nanoparticles are widely used in cosmetics, sunscreens, paints, coatings, photocatalytic degradation of various pollutants in water, confectioneries, white coloured sauces and dressings. Direct and indirect use of  $\text{TiO}_2$  nanoproducts will end up in domestic sewage (pharmaceuticals & food additives) via human excretion. Significant amount of nanoparticles leads to accumulate in sewage systems via runoff after rainfall (nanomaterials from paints) and washed nanoparticles from sunscreens and cosmetics. The sewage system or waste water treatment plant consists of a biological treatment based on bacterial and protozoan population facilitating degradation of organic material Study on field scale determination in a municipal waster water treatment plant,  $\text{TiO}_2$  concentration in each point, including plant influent, primary effluent, secondary effluent, tertiary effluent, primary solids, aeration basin, secondary solids, have been quantified.  $\text{TiO}_2$  concentrations in unfiltered samples were higher than the filtered samples which ware related to the concentrations of total suspended solids (TSS). Amount of Ti in primary effluent and tertiary effluent were 76 mg/L TSS and 4mg/L TSS respectively. The majority, 2000-3000  $\mu\text{g/l}$  (88%) of  $\text{TiO}_2$  accumulates in biosolids and only 10- 100 $\mu\text{g/l}$  (12%) remains and escapes via effluents.  $\text{TiO}_2$  concentrations in unfiltered samples were higher than the filtered samples which ware related to the concentrations of total suspended solids (TSS). Amount of Ti in primary effluent and tertiary effluent were 76 mg/L TSS and 4mg/L TSS respectively.  $\text{TiO}_2$  as a well known biocidal nanoparticle, aggregation in the biosolids may tend to affect the efficiency of waster water treatment plant in long term run via nanomaterial- microbe interactions, which is unclear and yet to be studied. In vitro evaluation of cytotoxicity of  $\text{TiO}_2$  nanoparticles on *E. coli* strain reported  $\text{LD}_{50}$  value of 1104.8 mg/l.  $\text{TiO}_2$  in waste effluents are discharged into the surface waters and  $\text{TiO}_2$  in biosolids are ended up in soil (through fertilization & land filling) or dumped in to the ocean, resulting ultimate termination in the ecosystem. Poster presentation include few graphs illustrating the fate of Ti nanoparticles in a Waste water treatment plant in Arizona and some Scanning microscopic images of  $\text{TiO}_2$  nanoparticles in different environments.

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## **EFFECTS OF PESTICIDES ON SALICYLIC ACID BINDING PROTEIN 2 (SABP2) AND PLANT DEFENSES**

Joannes Yuh, Alisha Dotson and Dhirendra Kumar, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Plants react to pathogen infection by inducing Systemic Acquired Resistance (SAR), a state of heightened defense throughout the plant. Salicylic acid (SA) has been shown to mediate plant defense mechanisms. SABP2 from tobacco has been identified to display a high affinity for SA and methylsalicylate (MeSA) and plays a role in the activation of SAR. Biochemical studies suggest that SABP2 has strong esterase activity with MeSA as substrate converting it to SA which is also a potent inhibitor of this catalysis. Crystal structures show that SABP2 belongs to the  $\alpha/\beta$  hydroxylase superfamily of enzymes. It has recently been shown that TetraFA (tetra fluoroacetophenone), a synthetic analog of SA competitively inhibits the esterase activity of SABP2 and blocks SAR development in TMV-infected plants. This study confirms the importance of SABP2 and MeSA for SAR development in plants. A common agricultural practice is the application of pesticides on plants to keep them healthy and pest free. Pesticides are not target specific, hence affecting life processes of both target and non target organisms (plants, insect pest and humans). These pesticides inhibit Acetylcholinesterase (AChE) which converts acetylcholine to choline. AChE inhibiting pesticides include; organophosphates (OP) (irreversibly bind AChE) and carbamates (temporarily inhibit AChE). About 70% of insecticides used in the United States are OP pesticides. Both

AChE and SABP2 belong to the  $\alpha/\beta$  hydrolase superfamily of enzymes and have esterase activities. We hypothesize that inhibitors of AChE may inhibit the esterase activity of SABP2, preventing MeSA conversion to SA. Plant may become more susceptible to further pathogen infection. Invitro studies showed that SABP2 activity is inhibited by pesticides. Currently we are trying to determine if pesticide treatment also blocks SAR development in TMV-infected plants. Three sets of 2-3 wks old wild type tobacco plants are being used. One set being the negative control labeled (A), the other; the test plant (B) and last positive control plant (C). The three lower leaves of plant A, B and C were treated with 20mM buffer, 2 $\mu$ g/ $\mu$ l TMV and 2 $\mu$ g/ $\mu$ l TMV respectively. At 48hp1°i (hp1°i: hours post primary inoculation) one upper leaf of 'A' and 'B' was sprayed with 100 $\mu$ M pesticide. Upper leaves of plant C received buffer only. At 72hp1°i, another upper leaf of 'A' and 'B' were sprayed with pesticide. If pesticide treatment inhibits SABP2 activity in plants then these plants will fail to develop SAR which is usually measured by little or no decrease in TMV induced lesion size. This research will have implications for the agricultural sector where large quantities of pesticides are used to protect plants from insect pests. Future emphasis when developing/choosing pesticides should be on effects of pesticides on microbial defense of the plant.

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## BRIDGED POLYSILOXANES CONTAINING FUNCTIONAL GROUPS

Guannan Zhou, Sen Mu and Aleksey Vasiliev, Department of Chemistry, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

The reduction of anthropogenic CO<sub>2</sub> emissions to address the consequences of climate change is a matter of concern for all developed countries. Separation of CO<sub>2</sub> is commonly practiced, although it is currently done at a relatively small scale compared to that required for significant impact on global CO<sub>2</sub> emissions.

Nowadays most of plants capture CO<sub>2</sub> with processes developed by Fluor Daniel Inc., Dow Chemical Co. and several other companies, and are based on chemical absorption using monoethanolamine containing solvents. However, the cost of CO<sub>2</sub> capturing by this method is very high (about \$40 per tonne). The amount of heat required to regenerate the solvent is quite high that significantly reduces the net efficiency of the fossil fuel-based power plants. More promising approach to CO<sub>2</sub> capture is based on use of solid adsorbents. Objective of the project is development of new nanocomposite adsorbents for CO<sub>2</sub> capture with high adsorption capacity (up to 30-35 wt. % of CO<sub>2</sub>). Their adsorption properties will be provided by high concentration of organic amine groups on the surface while the stability of mesoporous structure will be increased by organic bridges. For the syntheses we used bis[3-(trimethoxysilyl)-propyl]amine and N-methyl-3,3'-bis(trimethoxysilyl)- dipropylamine. In a typical polycondensation reaction a solution of trimethoxsilane was added to a solution of surfactant (sodium dodecylsulfate, octadecyltrim ammonium chloride or dodecylamine) and NaOH at room temperature. After complete precipitation of polymer, it was filtered, washed by water, and the surfactant was extracted by the appropriate solvent. The effect of nature and concentration of surfactant on the characteristics of the products was studied. Elemental analysis showed that the ratio C:H:N in the products was 5.8-6.3:12-15:1 that confirmed complete hydrolysis of trimethylsilyl groups and formation of polymer structures. IR spectra of all products contained characteristic absorption bands at 1105 and 970 cm<sup>-1</sup>. These bands can be attributed to Si-O-Si vibrations in polysiloxanes. Porous structure of obtained materials was studied using BET adsorption of nitrogen. Obtained polysiloxanes are the first bridged organic/inorganic hybrid materials containing reactive functional groups in their structure.

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# Social & Behavioral Sciences

## UNDERSTANDING ACCESS AND DESCRIPTIVE NORMS TO IMPROVE SKIN CANCER INTERVENTIONS

Katie Baker, MPH<sup>1</sup>, Joel Hillhouse, PhD<sup>1</sup>, Sherry Pagoto, PhD<sup>2</sup>, and Rob Turrisi<sup>3</sup>,

<sup>1</sup>Department of Community Health, College of Public Health, East Tennessee State University, Johnson City, TN,

<sup>2</sup>Department of Preventive and Behavioral Medicine, University of Massachusetts Medical School, Worcester, MA, <sup>3</sup>The Prevention Research Center, Pennsylvania State University, University Park, PA

Indoor tanning (IT) is an important risk factor for skin cancer, the most frequently diagnosed cancer in the US. Spray-on tanning (SOT) represents a safer alternative with the potential for integration into future skin cancer prevention initiatives. Both IT and SOT were evaluated in a large cross-sectional research project examining several theoretical models of health behavior including the Theory of Planned Behavior, Social Cognitive Theory and The Health Belief Model. For this project, we examined a subset of these participants to understand more practical aspects of skin cancer prevention targeting young women who engage in IT and/or SOT behaviors. We sought to understand how access, affordability and descriptive and image norms (participants' perceptions of friends' IT and SOT use as well as media stars' IT and SOT use) may predict IT and SOT intentions. Four hundred sixty-seven females (79.7% White, 7.5% Asian, 3.4% Hispanic, 2.8% Black) age 30 years and younger (mean = 22.42 years, sd = 3.82) were pulled from the larger dataset of 986 participants, and their responses to standardized questions of ease, access, affordability, friends' IT and SOT use, and media stars' IT and SOT use were analyzed. IT and SOT scales were developed using factor analysis and demonstrated strong to excellent reliability coefficients ( $\alpha = .69 - .90$ ). Linear regression analyses were performed using SPSS 17.0 to evaluate four scales relative to IT: Ease, Access/Affordability, Friends' Use, and Media Stars' Use and four scales relative to SOT: Ease/Access, Access to salons trusted to provide an attractive tan, Friends' Use, and Media Stars' Use as predictors of IT and SOT intentions. Both models proved significant in predicting intentions [IT:  $R^2 = .27$ ,  $F(4,459) = 41.92$ ,  $p < .001$ ; SOT:  $R^2 = .31$ ,  $F(4,457) = 51.68$ ,  $p < .001$ ]. Specifically, ease ( $b = -.18$ ,  $p < .001$ ), access/affordability ( $b = .13$ ,  $p = .005$ ) and friends' IT use ( $b = .40$ ,  $p < .001$ ) were significant predictors of IT intentions, and access to trusted salons ( $b = .18$ ,  $p < .001$ ), friends' SOT use ( $b = .38$ ,  $p < .001$ ) and media stars' SOT use ( $b = .17$ ,  $p < .001$ ) proved to be significant predictors of SOT intentions. These findings have implications for skin cancer prevention interventions. Interventions based in policy change should address issues regulating access to and affordability of IT. Examples include increasing the legal age to indoor tan to 18 years of age without the option for parental permission and taxing indoor tanning services. Future interventions could also emphasize SOT as an alternative to IT with a specific focus on the popularity of SOT among media stars. Young women are often intrigued by stars' attractiveness and educating women that stars achieved their look through a safer behavioral alternative could have a significant impact on IT behavior. Lastly, researchers should emphasize trust-building strategies among salons specializing in SOT and young female consumers. The more a young woman trusts a salon to provide her with an attractive tan, the more likely she is to engage in SOT.

## MULTIMEDIA'S ROLE IN TODAY'S CHRISTIAN CHURCH

Chris Ball, Digital Media Program, College of Business and Technology, East Tennessee State University, Johnson City, TN

This research addresses issues associated with the rising trend of audio and visual technology being used by Christian churches. In the past, churches relied heavily on the pulpit for communicating with their congregations, however, churches today are extending their reach by using tools such as the Internet, podcasts, and video to provide information to them and an even broader audience. Use of the Internet has provided believers with a multitude of resources to acquire religious information, and the capability to communicate through a variety of social networking sites such as Facebook, Twitter, and Myspace. Consequently, Christians are exposed to wide variety of teachings that are presented from many different

perspectives. This differs from the past where a congregation would only receive their pastor's own interpretation of the Scriptures. The wealth of information available online helps to establish foundational truths pertaining to various aspects of the Christian faith, which creates a system of accountability between churches to adhere to what is the "excepted belief". Many churches are now also incorporating audio and video elements in their services in order to bring the scriptures to life in a way that engages the congregation, and helps them to understand what is being communicated. Will technology play a crucial role in transforming the church as the number of churches who embrace it increases? The evidence shows that this is the direction churches are heading in, so expect to see a very tech-savvy church in the near future.

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### **COMMUNICATIVE ACTS AND WORD ACQUISITION IN TODDLERS WITH CLEFT PALATE**

Sarah Boyce, B.A., Gerri Martin, B.S., Chariti Skinner, B.B.A., Kaley Wetherholt, B.S. and Nancy Scherer, Ph. D., Department of Communicative Disorders, College of Clinical and Rehabilitative Health Sciences, East Tennessee State University, Johnson City, TN

Studies of early communicative development have shown a relationship between rates of communicative acts (CA) and the acquisition of words for typically developing children. Rates of CA provide a measure that predicts vocabulary growth. For children with cleft lip and/or palate, early vocabulary delays are common. Examination of rates of CA may provide a means for predicting which children show readiness for vocabulary expansion. The purpose of this study was to examine children's rates of CA, canonical vocalizations (CV), and words during the transition from prelinguistic to linguistic development. This retrospective study included 15 participants from northeast Tennessee that were drawn from a previous longitudinal study of nonsyndromic children with cleft lip and/or palate. There were nine females and six males; nine of the participants had cleft lip and palate, while the remaining six participants had cleft palate only. Through video recordings, children were evaluated at 18, 24, and 30 months of age, during which time they transitioned from the prelinguistic level (< 10 words on CDI) to the linguistic level (> 10). Data was recorded on the number of CA [e.g., protodeclaratives (PD) and protoimperatives (PI) to determine the purpose of communication], CV, and words the child produced at each age. The data was then converted to a rate per minute ratio. The results show that from the prelinguistic to the linguistic level, the children's average rate of CA overall increased from 1.94 to 3.08; PD from 18.86 to 19.45; words from 0.46 to 2.66 and both CV and PI decreased from 0.39 to 0.36 and 0.21 to 0.00 respectively. Results indicate that when compared to typically developing children, children with cleft lip and/or palate demonstrated delays when transitioning from prelinguistic to the linguistic level in rates of CA, CV, and words. This study did not show a significant correlation between CA at the prelinguistic level and word use at the linguistic level. When compared to the study of typically developing children conducted by Proctor-Williams, Dixon, Brown, Ringley, Barber, and Light-Newell (2007), the participants in this study demonstrated a delayed progression in the rate of CA, CV and word acquisition. Scores for PI and PD were not found to be statistically different across age groups for children with cleft lip and/or palate. Measurement of rates of CA at the prelinguistic level could assist clinicians in better assessing early communicative development in children with cleft lip and/or palate beyond traditional measures of vocalization. While this study did not find a significant difference between prelinguistic CA and linguistic CDI, CV, and words, a study with more participants is necessary to identify potential predictive relationships. This study identified differences in rates of CA, CV, and words, which suggest that early delays are not restricted to developmental parameters associated with sound production. Future studies should also incorporate testing at closer age intervals to more specifically determine their development and provide a better indication of rates of CA and CV per minute.

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**INTERACTIVE 3D VISUALIZATION:  
HOW INTERACTIVE 3D MODELS ARE IMPROVING THE PATHS  
OF COMMUNICATION WITHIN THE ARCHITECTURE COMMUNITY**

Jonathan Brooks, Digital Media Program, College of Business and Technology, East Tennessee State University, Johnson City, TN

This paper will discuss how 3D visualization has improved communication between architects and contractors by providing a more comprehensive representation of the architect's vision. Interactive 3D models can be used not only to show how the building will look, but to show potential users of the building how the different elements of the building will function. The use of interactive 3D representations has broken down the traditional system in construction that relied on 2D representations, such as drawings, blueprints, and elevations, to share information between architects and contractors. The interactive 3D models that are being used today offer future possibilities for innovation, such as stereoscopic 3D technology. This research will explore the benefits of using interactivity within virtual 3D environments as a way to communicate with and receive input from potential users using techniques, such as interactive walkthrough animations. This research will be used in order to suggest methods within 3D interactivity that could be used by architects in order to better communicate with engineers, contractors, and potential users.

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**VISUAL EFFECTS HAVE BECOME COMMON IN INSURANCE COMPANIES MARKETING STRATEGIES.**

Benjamin Harrison, Digital Media Program, College of Business and Technology, East Tennessee State University, Johnson City, TN

This research examines the increasing presence of visual effects within broadcast advertising for insurance companies. Computer generated characters, digitally enhanced accidents, and computer graphic lighting have been utilized in broadcast ads to gain interest, sell their products, and create memorable ads for future business opportunities. But, beyond the business aspect of the companies, what is the creative process behind the successful visual effects that companies such as Geico, Allstate, and General Automobile Insurance Inc. use? Why use visual effects to market their company? The individual strategies and marketing tactics that these insurance agencies use to draw the consumer's attention will be discussed to show the success rates due to recent visual effects.

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**IMPULSIVITY AS A MODERATOR OF THE ASSOCIATION BETWEEN ANGER AND SELF-HARM IN AN ETHNICALLY DIVERSE SAMPLE**

J. P. Hatfield, B.S., K. Walker, M.A., J. Holbrook, E. L. Jeglic, Ph.D., & J. K. Hirsch, Ph.D., Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Suicide is a leading cause of death during early adulthood, and is often preceded by suicide ideation and attempts. Individual characteristics, such as anger and impulsivity, may contribute to self harm behaviors. Anger, described as a "mover emotion," often involves behavioral activation and may contribute, in part, to engagement in potentially unsafe actions, including risk for suicidal behaviors. Anger-based actions may be expressed in an outward manner, as aggression, or inward, defined as harboring instead of expressing anger, or perhaps as self harm. Anger, and specifically inwardly directed anger have been shown to be associated with impulsivity, self-aggression, and suicide attempts. Personality characteristics, such as impulsivity, may exacerbate the association of anger to poor psychological outcomes, including depression. We hypothesized that a significant association would exist between level of anger and suicidal behavior, and that impulsivity would moderate this relationship. The ethnically diverse sample (41.5% Hispanic, 25.4% African American, 18.4% Caucasian) was comprised of 384 participants from a Northeastern

University (mean age=19.60, SD=3.12; 70% Female). Participants completed the Multidimensional Anger Inventory, the Barratt Impulsiveness Scale, and the Suicidal Behaviors Questionnaire. Utilizing hierarchical linear regressions, and covarying age, gender, and ethnicity, we tested models assessing total anger score alone; and, hostile outlook, anger-arousal, anger-eliciting situations, and inwardly-directed and outwardly-directed anger subscales both independently and combined. In the first model, impulsivity moderated the association between total anger score and suicidal behaviors ( $t = 2.52$ ,  $p=.012$ ,  $Un \beta = .001$  [ $SE = .001$ ]), such that higher levels of impulsivity were associated with a stronger relationship between anger and suicidal behaviors. In the second model, impulsivity moderated the association between inwardly-directed anger and suicidal behaviors ( $t = 3.45$ ,  $p<.01$ ,  $Un \beta = .01$  [ $SE = .001$ ]); higher levels of impulsivity were associated with a stronger relationship between inward-anger and self harm. Impulsivity also moderated the association between anger-arousal and suicidal behaviors ( $t=2.21$ ,  $p<.05$ ,  $Un \beta=.003$  [ $SE= .002$ ])); higher levels of impulsivity were associated with a stronger relationship between anger-arousal and self harm. In a combined model examining all subscales, impulsivity moderated the relationship between inward-anger and suicidal behavior ( $t = 3.13$ ,  $p<.01$ ,  $Un \beta = .015$  [ $SE = .005$ ])), over and above the effects of the other subscales and covariates. Our results suggest that young adults experiencing anger, particularly inwardly-directed anger, and who are also impulsive, may be at increased risk for suicidal thoughts and behaviors. During suicide risk assessment and prevention efforts, it is important to recognize the potentially dangerous combination of impulsivity and aggression.

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#### **BREAST CANCER STAGING AND TREATMENT AMONG WOMEN RESIDING IN APPALACHIAN AND NON-APPALACHIAN KENTUCKY: A POPULATION-BASED STUDY**

Megan Quinn<sup>1</sup>, Julie Worthington<sup>1</sup>, Kristen White<sup>1</sup>, Toni Bounds<sup>1</sup>, and Siran Koroukian<sup>2</sup>

<sup>1</sup>Department of Biostatistics and Epidemiology, College of Public Health, East Tennessee State University, Johnson City, TN.

<sup>2</sup>Department of Epidemiology and Biostatistics, College of Medicine, Case Western Reserve University, Cleveland, OH.

Despite lower age-adjusted incidence rates of female breast cancer in Appalachian Kentucky (AK) than in non-Appalachian Kentucky (non-AK; 114 vs. 126 per 100,000), women residing in AK experience a rate of mortality comparable to that of their non-AK counterparts (26 and 25 per 100,000 respectively). These findings may be reflective of late-stage diagnosis for women in AK. This study's objective was to compare female breast cancer stage at cancer diagnosis and treatment among women residing in AK and non-AK. Data on all female breast cancers in Kentucky diagnosed during 2000-2006 were obtained from the Surveillance, Epidemiology, and End Results (SEER) database. Age of diagnosis, race, year of diagnosis, stage, surgery, and radiation therapy were included from SEER. SEER was linked to the Appalachian Regional Commission (ARC) data by the Federal Information Processing Standard (FIPS) code to identify Appalachian counties. The Kentucky SEER and ARC data were linked to the Area Resource File (ARF) by the FIPS code to obtain the following county-level data: percent persons below the federal poverty level; proportion of persons without insurance; proportion of persons aged 25+ years with high school diploma or more; and primary care health provider shortage areas; and number of mammography units, radio-oncology patient care physicians, and general surgeons in patient care per 100,000 county residents. Frequencies, percents, and corresponding chi-squares were calculated. Given the nature of multilevel data, hierarchical logistic models were used to calculate odds ratios (OR) and corresponding 95% confidence intervals (CI). The average age at diagnosis for AK and non-AK breast cancer cases was approximately 60 years of age. A higher proportion of women residing in AK were White (98.4% vs. 91.5%), had regional stage (36.2% vs. 33.9%), had distant stage (5.3% vs. 4.7%), and had unknown stage (4.4% vs. 4.1%) compared to women residing in non-AK (all  $p\leq 0.01$ ). However, a lower proportion of women residing in AK had localized stage (57.6% vs. 60.3%) compared to women residing in non-AK. Although the unadjusted OR indicated women residing in AK were 9% more likely to have breast cancer surgery compared to women residing in non-AK (Unadjusted OR 1.09, 95%CI 0.90, 1.32), the multivariate model did not yield statistically significant differences (Adjusted Odds Ratio (AOR) 0.81, 95%CI 0.63, 1.08). Similarly, residing in AK was not significantly associated with receipt of radiation therapy (AOR 0.79,

95%CI 0.56, 1.12) in the multivariate model. Residing in AK was not associated with lower likelihood of being diagnosed with localized stage or receipt of surgery or radiation therapy. Future studies are needed to further explore the high cancer burden among AK.

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### **USE OF 3D VIRTUAL TECHNOLOGY IN MEDICAL EDUCATION**

Saikiran Boberoi Shaik, Digital Media Program, College of Business and Technology, East Tennessee State University, Johnson City, TN

Over the past few decades the traditional teacher-to-student method of teaching has taken a leap forward with interactive learning. Recent innovations in computer technologies such as 3d virtual have brought new techniques in medical field. With an evolving modern medicine new procedures tend to become more and more complex. In order to learn these new evolving techniques there is no better way than to practice. But training with live patients is very risky and so virtual reality (VR) technique is being widely applied. VR is a part of computer science, allows computer-based models of the real world to be generated, and provides humans with a means to interact with these models through new human-computer interfaces. VR is being applied to a wide range of medical areas, including medical education training, surgery and diagnostics assistance. In medical education, VR opens new opportunity in the teaching of medicine and creates new effective learning procedures for the students. Virtual reality modeling language (VRML) technology provides a efficient and simple way to create such an environment and can be easily deployed in the classroom. The acceptance of VRML/X3D as a WWW file standard for 3D scene description provides the foundation of creating an interactive virtual learning environment. WWW, VRML/X3D and VTK technology can be easily deployed in the classroom due to its simplicity and very efficient and as the hardware requirements for the client are very low, a standard PC is enough for accessing it.

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# Division III – Graduate Students more than 2 Years

## Biomedical Sciences, Natural Sciences & Mathematics, and Social & Behavioral Sciences

### TRULY BIRD-POLLINATED? EVIDENCE FOR BEE-POLLINATION IN *CAMPsis RADICANS* (BIGNONIACEAE)

Andrea A. Edge, Byron N. Van Nest and Darrell Moore, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

While classifying plants into pollination syndromes can be useful to describe potential pollinators, research suggests that plant-pollinator interactions are much more intricate than these broad syndromes imply. Many plants are pollinated by visitors other than what a particular syndrome suggests. Pollinator interactions may be strongly influenced by flower morphology as well as the rewards that the flowers offer. A deeper understanding of floral physiology and morphology, including changes that may occur with time of day or with age, may provide insights into the dynamics of plant-pollinator interactions. Flowers of the trumpet vine *Campsis radicans* are described as possessing characteristics of the classical bird-pollination syndrome. Our primary research goal was to determine the pollinators of trumpet creeper and how the floral rewards might influence visitation. This was achieved by performing extensive 24-h observations of flowers and documenting all visitors, as well as determining the effectiveness of the visitors by recording which floral parts they contacted. We also recorded visitor behaviors while in the flowers, such as nectar collection or pollen collection, and investigated the effect certain visitors had on pollen removal. Nectar characteristics were investigated to determine if *C. radicans* is adapted for typical bird-pollination or another type of pollinator. Volume, concentration and total sugar of standing crop were measured in flowers open to pollination throughout the day. Flowers also had nectar artificially removed to determine any effects multiple removals, age, or time of day had on nectar regeneration. Our observations showed that hummingbird visits were very rare, and the most common visitors were bumble bees, honey bees and sweat bees. Honey bees and sweat bees preferred to visit flowers with pollen, whereas bumble bees did not show a preference. Bumble bees contacted the anthers and stigmas more than 70 % of the time, usually when collecting nectar and were present consistently throughout the daylight hours. Sweat bees and honey bees rarely touched stigmas and acted as pollen robbers. Volume of standing crop was high in early morning hours and declined throughout the day, reaching its lowest point in late afternoon. Concentration remained relatively constant at 30 %. There were no significant differences in the amount of nectar produced with respect to the number of removals, although data showed that age and time of day affected regeneration. Our research suggests that, while *C. radicans* exhibits characteristics of bird-pollination, bumble bees are the primary pollinators, at the sites we examined. Volume and concentration of standing crop is also characteristic of flowers that are pollinated by bees. It is highly possible that *C. radicans* is going through an adaptive shift towards bumble bee pollination in response to the absence of hummingbirds in highly disturbed and fragmented habitats.

## **DETERMINING FURAN CONCENTRATIONS IN INDOOR AIR SAMPLES COLLECTED DURING THE PREPARATION OF HEAT-TREATED FOODS**

Leslie Hammond and Dr. Tricia Metts, Department of Environmental Health, College of Public Health, East Tennessee State University, Johnson City, TN

Furan is a polar, heterocyclic volatile organic compound often found in canned or jarred heat-treated foods. Some examples of foods found to contain furan include baked beans, chili, soups and tomato-based pastas and sauces. Furan is extremely volatile, transitioning to a gaseous state at temperatures slightly higher than 25°C (approximately room temperature). During the preparation of heat-treated foods, furan is emitted into the surrounding air. Inhalation of furan is a human health concern because the compound is currently listed as a possible carcinogen by the International Agency for Research on Cancer (IARC 1995). Previous research has focused on the content of furan within a particular food sample, ignoring the potential effects of inhalation exposure. Because furan volatilizes out of food at a low temperature, it is doubtful that ingestion is an exposure route assuming that the food is heated. It is more likely that inhalation of furan is the primary route of exposure to humans. Indoor air samples were actively collected from the simulated breathing area surrounding heated food samples with a personal sampling pump. The air samples were collected on sorbent tubes then subjected to a thermal desorption process. The thermal desorption process released the gaseous furan collected on the sorbent tubes, thus allowing the sample to be carried by helium gas into a gas chromatography column (GC). The capillary column of the GC provided a stationary phase to separate molecules collected from the indoor air samples. Based on chemical characteristics of each molecule and their reaction with the GC capillary column, the molecules elute from the GC and are carried by helium into the mass spectrometer (MS) which will provide a profile of the sample. From the profile, the compound can be determined by their specific mass to charge ratio. This research attempts to provide information about the inhalation of furan vapors emitted during the preparation of heat-treated foods. Development and optimization of a detection method using thermal desorption, gas chromatography and mass spectroscopy were the main objective of this project. Additional investigations will be necessary to determine if this exposure route poses a risk to human health.

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## **RIMONABANT IS AN INHIBITOR OF ACAT AND PREVENTS FOAM CELL FORMATION**

Courtney Netherland and Douglas Thewke, Department of Biochemistry and Molecular Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Atherosclerosis is a chronic inflammatory disease characterized by the buildup of cholesteryl esters (CE) and other lipids within arterial walls. The intracellular synthesis of CE is catalyzed by acyl-coenzyme A: cholesterol acyltransferase (ACAT) using cholesterol and fatty acyl-CoA as substrates. Two ACAT isoforms, ACAT1 and ACAT2, have been identified and both play key roles in atherosclerosis. In macrophages, ACAT1 is responsible for the esterification of cholesterol derived from receptor-mediated uptake of modified low density lipoproteins (LDL), such as oxidized LDL (oxLDL) in the intima of the arterial wall. The ACAT1-generated CE is stored in cytosolic lipid droplets, resulting in macrophages transitioning into foam cells, a hallmark of early atherosclerotic lesions, known as fatty streaks. ACAT1 also plays a role in oxLDL-induced macrophage apoptosis, a process known to be anti-atherogenic. ACAT2 plays an important role in very low density lipoprotein (VLDL) secretion from the liver, while ACAT2 in the intestine participates in the absorption of dietary cholesterol. Thus, ACAT inhibition exerts beneficial effects on atherosclerosis via both attenuation of foam cell formation and reduction of dietary cholesterol uptake. Rimonabant is an antagonist of the type 1 cannabinoid receptor (CB1) and was originally developed as an anti-obesity drug. In clinical trials, Rimonabant was found to reduce atherosclerotic lesion volume and improve cardiovascular risks factors beyond those expected from weight loss alone. In a mouse model of diet-induced atherosclerosis, Rimonabant effectively blocked formation of atherosclerotic lesions by a mechanism that was independent of effects on body weight. Recently, we observed that two compounds (AM-251 and SR144528) structurally related to Rimonabant are effective ACAT inhibitors. Therefore, we hypothesized that the anti-atherosclerotic effects of Rimonabant might be

due, at least partly, to inhibition of ACAT. To test this hypothesis, we examined the effect of Rimonabant on CE synthesis in macrophages and on ACAT activity in vitro. We show that Rimonabant dose dependently reduced the incorporation of [<sup>3</sup>H] oleic acid into CE in Raw 264.7 macrophages, in the presence and absence of ACAT stimulation by an exogenous oxysterol, 7-ketocholesterol (7KC), with an IC<sub>50</sub> of ~1.5µM. Rimonabant inhibited CE synthesis equally in mutant CHO cells, which lack endogenous ACAT, expressing human ACAT1 or ACAT2. Consistent with inhibition of ACAT, Rimonabant treatment of macrophages resulted in attenuation of two ACAT-dependent macrophage processes, oxysterol-induced apoptosis and acetylated LDL-induced macrophage foam cell formation. These results support the hypothesis that the anti-atherosclerotic effects of Rimonabant may be due in part to inhibition of ACAT.

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#### **MAPPING TASTE IN THE REWARD SYSTEM: VENTRAL TEGMENTAL AREA NEURONAL ACTIVATION VIA TASTE NERVE STIMULATION**

Marla K. Perna and Theresa. A. Harrison, Department of Anatomy and Cell Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

The ventral tegmental area (VTA) of the brain is known to play an important role in processing the appetitive properties of natural and drug-induced reward. The lateral hypothalamus (LH) also has been implicated in reward processes, particularly those involving food and feeding. Past research has shown that the VTA receives significant projections from the LH, and that the integrity of this LH-to-VTA circuit is necessary for the increased intake of highly palatable foods over ordinary chow seen in sated rats. Taste is a major determinant of the palatability of foods, but it is unclear just how taste information reaches these components of the reward system. One goal of our current research is to define specific pathways processing taste reward and determine the components representing taste reward at the cellular level. In this initial study, the effects of electrical stimulation of individual taste afferent nerves on the expression of the immediate early gene product c-Fos within the VTA are being examined to define populations of neurons that may be responsive to taste experience in this reward circuit component. In our first experiment, electrical stimulation (500msec trains of 200 µsec pulses at 0.67 Hz for 40 min) of the lingual branch of the IX<sup>th</sup> (glossopharyngeal) nerve (LT), which supplies circumvallate and posterior foliate papillae of the posterior tongue, was carried out in anesthetized rats. Rats were sacrificed one hr after stimulus termination, brains were fixed by perfusion and removed for subsequent immunohistochemical processing for Fos protein. Neurons expressing c-Fos were plotted in drawings through the VTA and their numbers in specific subdivisions were counted in stimulated and sham-operated control rats. Boundaries and subdivisions of the VTA were defined based on cresyl violet and tyrosine hydroxylase staining in control brain sections. Results to date indicate that taste nerve stimulation produces a substantial change in the pattern of c-Fos expression in the VTA. Overall, a decrease of about 30% in the number of c-Fos-labeled cells as compared to sham-operated control animals was observed. This decrease was especially notable in the posterior portions of the nucleus. These data suggest a significant inhibitory effect of LT nerve stimulation, which varies across different regions of the VTA. This could result from effects on local GABAergic neurons, and/or decreased tonic activating input to these areas. Experiments are underway to compare the effects of stimulation of other taste nerves (i.e., chorda tympani, greater superficial petrosal), and to determine the source(s) of the possible inhibition.

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## **CANNABINOID (WIN 55,212-2)-INDUCED APOPTOSIS IN PANCREATIC TUMOR CELLS INVOLVES UP REGULATION OF PRO-APOPTOTIC GENES AND DOWN REGULATION OF ANTI-APOPTOTIC GENES**

Theresa Pickle and Douglas Thewke, Department of Biochemistry and Molecular Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Pancreatic cancer is the fourth leading cause of cancer related deaths. The mean survival rate is ~6 months, and only 4% of patients survive five years. Despite extensive testing, only one chemotherapy agent (gemcitabine) has been found to produce any benefit to these patients, unfortunately, the clinical response rate to gemcitabine is less than 10% with life prolongation being only 6 weeks on average. Cannabinoids, such as Δ9-tetrahydrocannabinol (THC), the active agent of *Cannabis sativa*, exhibit some anti-tumor properties via induction of apoptotic mechanisms. Cannabinoids produce their biological effects by engaging specific receptor-mediated signaling pathways. To date, two cannabinoid-specific receptors, designated CB1 and CB2, have been cloned and characterized. The current study was conducted to investigate the potential use of cannabinoids as an anti-tumor treatment in pancreatic cancer. Using RT-PCR we found evidence for expression of CB1 and CB2 in three human pancreatic cancer tumor cell lines (AsPC1, CaPan1, and Mia-PaCa2). Treatment with the synthetic cannabinoid, Win55,212-2, induced apoptosis, as determined by caspase-3 activity, in Mia-PaCa2 cells but not in non-neoplastic human pancreatic duct epithelial (HPDE) cells. The induction of caspase-3 activity by Win 55,212-2 in Mia-PaCa2 cells was prevented by a CB1 -specific antagonist, AM-251, but not by a CB2 -specific antagonist, SR144528. In contrast, induction of caspase-3 activity in AsPC1 cells was inhibited by SR144528 but not AM-251, while induction of apoptosis in CaPan1 cells was not affected by either antagonist. We also employed oligonucleotide microarray technology to compare the effect of Win55,212-2 treatment on the expression of 112 apoptosis genes in Mia-PaCa2 and HPDE cells. Semi-quantitative RT-PCR verified that Win 55,212-2 increases the expression of the pro-apoptotic genes, Bak1 and Traf3, and reduced the expression of anti-apoptotic genes Birc8, BCL2 L10, and XIAP in Mia-PaCa2 cells. In contrast, Win 55,212-2 reduces the expression of Traf3, and has no significant effects on BCL2 L10 and XIAP in HPDE cells. Furthermore, immunoblot analysis showed that Win 55,212-2 treatment reduced expression of an anti-apoptotic member of the Bcl family, Bcl-xL, in pancreatic cancer tumor cell lines but not in HPDE cells. These results demonstrate that a cannabinoid, Win 55,212-2, inhibits the viability of several pancreatic tumor cell lines, in part, by selectively inducing apoptosis via CB1/CB2 receptor -dependent and -independent mechanisms. In addition, these results suggest that Win55,212-2 activates apoptosis in Mia-PaCa2 cells by selectively altering the expression of pro- and anti- apoptotic genes.

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## **INVESTIGATION OF ENVIRONMENTAL FATE, TRANSPORT, AND TRANSFORMATION OF SILVER NANOPARTICLES IN THE WASTE DISPOSAL SYSTEMS**

Lok R. Pokhrel and Brajesh K. Dubey, Department of Environmental Health, College of Public Health, East Tennessee State University, Johnson City, TN

With rapidly emerging nanotechnology and ever-increasing novel applications, which range from consumer products to micro-electronics, therapeutics to environmental remediation, and threat detection to space exploration among others, nanomaterials can be envisioned to greatly benefit mankind; yet apprehension on the use of nano-incorporated products does exist due to their potential toxic effects to human health and the environment. Materials in bulk may have different characteristics to that of nano-sized ones ( $1\text{nm}=10^{-9}\text{m}$ ) primarily because of larger surface area to volume ratio of the nano-sized particles. With extensive use of nano-incorporated products (e.g., cosmetics, personal care products, etc.), it is highly likely that they will reach the waste disposal systems (e.g., landfills) at the end of their service life. Silver nanoparticle (AgNP), because of its antimicrobial properties, is one of the most used nanoparticle, today. Moreover, silver ions' inherent toxicity to aquatic organisms and current situation with paucity of data necessitate better understanding with regard to fate and transport of AgNPs in the waste disposal systems. Following a proactive approach, this research is aimed to investigate the fate, transport and transformation of AgNPs in

different types of simulated solidwaste landfills under environmentally realistic conditions. Specifically, the objectives of this research are: (1) to evaluate the fate, transport and transformation of AgNPs in the waste disposal and treatment systems with special focus on conventional Municipal Solid Waste (MSW) landfill, Construction and Demolition (C&D) landfill and bioreactor landfill with or without leachate recirculation and air injection; (2) to investigate if AgNPs are found in real-world leachate; if yes, what would be the particle size, concentration, form (particle or ions or both or combined state) and colloidal state (e.g., aggregate, agglomerate, flocculate, etc.) of the nanoparticles?; (3) to investigate how AgNPs would interact with organic compounds, such as humic and fulvic acids, present in landfill leachate; and (4) to investigate if AgNPs could migrate through landfill liners. Employing various particle sizes, concentrations, pH, and coatings to the AgNPs, the fate and transport of the AgNPs will be investigated and compared by simulating different types of lab-scaled landfills under aerobic and anaerobic conditions, and with or without leachate recirculation. Exploration of foregoing questions is expected to provide important evidence based information on the behavior of AgNPs under a range of practically and environmentally relevant conditions, which would contribute to the science of risk assessment and waste management of the engineered nanoparticles, in general, and AgNPs, in particular. This poster will highlight the process of synthesis of AgNPs, briefly describe the procedures that would be used to characterize the synthesized NPs, experimental procedures to simulate the landfills in the laboratory settings, and the methods employed to study the fate and transport of AgNPs.

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### **CHARACTERIZATION OF THE RPA-P53 INTERACTION AND ITS PHOSPHORYLATION-DEPENDENT REGULATION AND SIGNIFICANCE IN DNA REPAIR AND DNA DAMAGE CHECKPOINTS**

Moises A. Serrano<sup>1</sup>, Marina Roginskaya<sup>1</sup>, Mohan Dangeti<sup>2</sup>, Zhengke Li<sup>1</sup>, Phillip R. Musich<sup>1</sup>, Steve Patrick<sup>2</sup>, and Yue Zou<sup>1</sup>

<sup>1</sup>Department of Biochemistry and Molecular Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

<sup>2</sup>Biochemistry & Cancer Biology Department, University of Toledo Medical Center, Toledo, OH

Replication protein A (RPA), a eukaryotic single-stranded DNA (ssDNA)-binding protein, is an essential component of almost all DNA metabolic pathways. In response to genotoxic agents, the N-terminus of the RPA32 subunit of the hetero-trimeric RPA complex undergoes hyperphosphorylation. There is growing evidence that RPA32 hyperphosphorylation (hyp-RPA) plays an important role in DNA repair and DNA damage checkpoint regulation. We hypothesize that the regulation is achieved through a hands-off mechanism in which RPA hyperphosphorylation is involved in the p53-dependent DNA damage checkpoint regulation. We propose that the hyperphosphorylation of RPA disrupts the RPA-p53 interaction releasing hyp-RPA which stimulates DNA double-strand break (DSB) repair and frees up the p53 for checkpoint activation. To test our hypothesis, we have established human cell lines expressing recombinant RPA32 phosphorylation mutants. We employed co-immunoprecipitation assays of complexes generated *in vitro* and existing *in vivo* to evaluate RPA32 association with p53. Our *in vitro* experiments showed that the hyperphosphorylation enhanced the binding between the purified hyp-RPA and p53; and pre-incubation of RPA with ssDNA had no effect. Conversely, in cells treated with genotoxic agents, however, the hyperphosphorylation was found to inhibit the interaction of cellular RPA and p53. Further investigation indicated that DNA damage-induced phosphorylation of p53 in cells also is involved in the modulation of p53-RPA interaction. Lack of the phosphorylation-mediated regulation of p53-RPA binding compromised DSB repair in cells exposed to camptothecin. Taken together, our results suggest that hyperphosphorylation of RPA and p53 phosphorylation play an important role in coordination of DNA damage checkpoints and DNA repair via regulation of p53-RPA interaction in a synergistic manner.

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## HUMAN CATHEPSIN G EXPRESSION IN *KLUYVEROMYCES LACTIS*

Eliot T. Smith and David A Johnson, Department of Biochemistry and Molecular Biology, Quillen College of Medicine, Johnson City, TN

Stored in cytoplasmic granules in mast cells and neutrophils, the human serine protease Cathepsin G (CatG) participates in bacterial killing and inflammatory responses of the immune system. CatG exhibits dual specificity for substrates of both trypsin-like and chymotrypsin-like proteases; furthermore, this enzyme undergoes an unusual processing step to remove a sequence of residues from the carboxyl terminus. Expression of recombinant human CatG (rhCatG) will allow further investigation into these poorly understood phenomena and the potential implications of their malfunction. Current expression attempts in *K. lactis* show promise in generating a fusion protein of rhCatG linked to domains facilitating expression, secretion, detection, and activation of the recombinant enzyme. The plasmid vector pKLAC1 was modified to replace the original  $\alpha$ -mating factor with a codon optimized form of the gene. The codon optimized gene for rubredoxin was linked to the 3' end of the  $\alpha$ -mating factor gene, generating a new plasmid, pK $\alpha$ R. Upon transformation into *K. lactis*, homologous recombination into the genome places the gene under control of the galactose-inducible LAC4 promoter, which regulates transcription of the  $\beta$ -galactosidase gene. A separate gene, coding for the enzyme acetamidase and regulated by a separate promoter, confers the ability to utilize acetamide as a nitrogen source. Selection of positive transformants tests for acetamide metabolism on yeast carbon base (nitrogen-free) with acetamide. The current, codon optimized, rhCatG fusion protein construct contains the rubredoxin domain linked to the CatG amino-terminus by 6 histidine (His6) residues and an enterokinase cleavage site (D4K). The  $\alpha$ -mating factor domain at the amino-terminus of rubredoxin targets the fusion protein for secretion and is then removed by Kex2 protease in the Golgi apparatus. Although Kex2 protease targets Lys-Arg residue pairs for cleavage after arginine, research shows that Kex2 also targets Arg-Arg sites. Because rhCatG contains several Arg-Arg sites, the amino acid sequence has been modified to remove these potential Kex2 cleavage sites. Upon binding Fe<sup>3+</sup> in the expression media through 4 cysteine residues, the rubredoxin domain produces a red color change. The accumulation of this colored protein can be monitored by measuring absorbance of light at 380 nm and 490 nm wavelengths, enabling quick initial screening for positive expression. The His6 site allows purification based on nickel affinity. Enterokinase added to the fusion construct should release active rhCatG, which could be purified by affinity for a reversible rhCatG inhibitor, soybean trypsin inhibitor (STI). Enzyme kinetic studies will then determine the catalytic efficiency (Kcat/KM) of rhCatG for cleavage of a synthetic peptide-thiobenzyl ester substrate, which produces a measureable color change. Upon successful identification of a colony that produces active rhCatG, further studies will modify the amino acid sequence for the enzyme, specifically to improve understanding of the uncommon carboxy-terminal processing and dual-specificity of this enzyme. Supported by the National Heart, Lung and Blood Institute via grant 1R15HL091770.

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## EXPRESSION OF RECOMBINANT HUMAN ENTEROKINASE LIGHT CHAIN IN *KLUYVEROMYCES LACTIS*

Eliot T. Smith, Jessica Pugh, and David Johnson, Department of Biochemistry and Molecular Biology, Quillen College of Medicine, Johnson City, TN

Recombinant human enterokinase light chain (rhEKLC; enteropeptidase) was expressed using the yeast *Kluyveromyces lactis*. Enterokinase activates trypsinogen via cleavage of the Lys~X bond in the sequence Asp-Asp-Asp-Asp-Lys~X to initiate the activation of pancreatic zymogens. This specificity makes it ideal for cleaving fusion protein constructs to release target domains. Gene amplification by a PCR reaction added a Kex2 cleavage site to the 5' end and restriction sites to both ends. To achieve protein secretion, the EKLC gene was cloned into the *K. lactis* vector pKLAC1 downstream of the  $\alpha$ -mating factor domain, directing the protein through the endoplasmic reticulum with removal of  $\alpha$ -MF in the Golgi and secretion of active rhEKLC. Engineering was confirmed by sequencing the pKLAC1-rhEKLC vector before using the linearized vector to transform *K. lactis* GG799 chemically competent cells. For screening purposes, the transformants were grown on Yeast Carbon Base agar media with 5mM acetamide as the only nitrogen

source. The pKLAC1 plasmid has an amdS gene for acetamidase which enables acetamide metabolism as a nitrogen source and allows transformant selection. Homologous recombination of the pKLAC1-rhEKLC vector placed rhEKLC under the control of the LAC4 promoter of *K. lactis* for galactose inducible expression. Clones were grown in 24 well plates and screened for rhEKLC production using the synthetic substrate Z-Lys-thiobenzyl ester. Activity increased over five days when grown in shake flasks on synthetic media and rhEKLC was purified from cell-free media by affinity chromatography on a soybean trypsin inhibitor column. Further purification and characterization will be performed on rhEKLC.

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## **STAGING AND TREATMENT OF COLORECTAL CANCER CASES IN KENTUCKY: APPALACHIA VS. NON-APPALACHIA**

Sreenivas P. Veeranki<sup>1</sup>, Julie Worthington<sup>1</sup>, Sreekiran Thotakura<sup>1</sup>, Toni Bounds<sup>1</sup>, and Siran Koroukian<sup>2</sup>

<sup>1</sup>Department of Biostatistics and Epidemiology, College of Public Health, East Tennessee State University, Johnson City, TN.

<sup>2</sup>Department of Epidemiology and Biostatistics, College of Medicine, Case Western Reserve University, Cleveland, OH.

Colorectal cancer (CRC) is the third commonly diagnosed cancer and third leading cause of death among men and women in the United States (US). Age-adjusted incidence rates of invasive CRC are higher in Appalachia than the US (males 67 vs. 60 per 100,000; females 48 vs. 44 per 100,000). Similarly, premature mortality (i.e. deaths prior to the age of 65) for CRC is higher in Appalachia than the US. Higher incidence and premature mortality rates may indicate late-stage diagnosis due to underutilization of cancer screening and/or lack of cancer treatment among Appalachians. The objective of this study was to examine staging and treatment among CRC cases residing in Appalachian Kentucky (AK) and non-Appalachian Kentucky (non-AK). Data on all colon and rectal cancer cases diagnosed during 2000 to 2006 were identified from Surveillance, Epidemiology and End Results (SEER) database. Age and year of diagnosis, race, gender, staging, and cancer treatment (surgery and radiation) were available from SEER. Data regarding AK county status was identified from Appalachian Region Commission. County-level variables from the Area Resource File included the following: percent persons below the federal poverty level; proportion of persons without insurance; proportion of persons aged 25+ years with high school diploma or more; primary care health provider shortage areas; and number of mammography units, radio-oncology patient care physicians, and general surgeons in patient care per 100,000 county residents. Frequencies, percents, and corresponding chi-squares were calculated. Due to the multilevel nature of the data, hierarchical logistic regression models were used to calculate odds ratios (OR) and corresponding 95% confidence intervals (CI). This study included a total of 9,403 CRC cases, of which 2,739 (29.1%) resided in AK. The mean age of diagnosis was slightly younger for AK compared to non-AK (66.2 vs. 67.4 years,  $p=0.0001$ ). A higher proportion of cases residing in AK were White (98.7% AK, 91.5% in non-AK,  $p= <0.0001$ ). The stage distribution for AK versus non-AK was as follows: 38.2% vs. 40.5% for local; 34.5% vs. 34.0% for regional; 19.3% vs. 18.5% for distant; and 8.0% vs. 7.0% for unknown ( $p=0.03$ ). Although the unadjusted OR indicated cases residing in AK were 12% less likely to have surgery compared to cases residing in non-AK (Unadjusted OR 0.88, 95%CI 0.70, 1.10), the multivariate model did not yield statistically significant differences (Adjusted OR (AOR) 1.03, 95%CI 0.71, 1.48). Similarly, residing in AK was not significantly associated with receipt of radiation therapy (AOR 0.94, 95%CI 0.76, 1.17). Residing in AK was not associated with lower likelihood of receiving surgery or radiation therapy. A higher percentage of regional and distant staged CRC was found for AK compared to non-AK, indicating underutilization of CRC screening. AK should be targeted for CRC screening education and interventions.

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## **BORDERLINE PERSONALITY DISORDER AND SUICIDE IN COLLEGE STUDENTS: THE ROLE OF SOCIAL PROBLEM SOLVING ABILITY.**

K. L. Walker, J. Lehmann, R. Humphreys, E. J. Jeglic, and J. K. Hirsch, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN; John Jay College of Criminal Justice, City University of New York, New York, NY

Borderline Personality Disorder (BPD) often manifests itself during early adulthood, and several studies indicate that BPD is a diagnosis researched and treated in college student samples. Borderline Personality Disorder has several hallmark characteristics including frantic efforts to avoid abandonment, patterns of intense and extreme relationships, identity disturbance, impulsivity, and intense expressions of anger . BPD is also associated with increased levels of suicidal ideation and frequent suicide attempts ,and approximately 10% of individuals with BPD die by suicide . Suicide is already a significant problem among college students, which may be exacerbated by the presence of symptoms of Borderline Personality Disorder. Further, deficits in problem solving abilities may contribute to risk for suicide That we know of, however, no other published data has examined the inter-relationships between symptoms of BPD, problem-solving capabilities and suicide outcomes in college students. We investigated the relationship between borderline personality characteristics, social problem solving ability, and suicide behaviors. We hypothesized that individuals with higher levels of borderline personality characteristics would report higher suicide behaviors. We also hypothesized that social problem solving ability would moderate this relationship, such that participants who reported higher levels of problem solving ability would report decreased levels of suicide behaviors in the presence of borderline characteristics. Our ethnically diverse sample (41.5% Hispanic, 25.4% African American, 18.4% Caucasian) of 384 participants (70% Female; Mean Age = 19.60, SD = 3.12) were recruited from a large Northeastern university. Participants completed the Structured Clinical Interview for DSM Diagnoses – Personality Disorders (SCID-PD), the Suicidal Behaviors Questionnaire (SBQ), and the Social Problem Solving Inventory-Revised (SPSI-R). At the bivariate level, borderline personality characteristics were significantly positively associated with suicide behaviors ( $r=.388$ ,  $p<.001$ ). Social problem solving ability was significantly negatively correlated with suicide outcomes ( $r=-.36$ ,  $p<.01$ ). Using a multivariate, hierarchical linear regression, we found that greater levels of borderline characteristics significantly predicted suicide behaviors and social problem solving ability moderated this relationship ( $t=-3.677$ ,  $p<.001$ ;  $\text{UnB}=-.025$  [ $\text{SE}=.007$ ]), in support of our hypothesis. Our findings are consistent with previous literature indicating the protective role of problem-solving ability in suicide behaviors ; our findings extend this research to the context of Borderline Personality Disorder. Our findings may also have clinical implications for reducing self harm in individuals with BPD; problem-solving may be a potential therapeutic strategy. Increasing the problem-solving capabilities of a client may result in greater competence, thereby reducing suicide risk. Limitations of our study include use of a college student population and a cross-sectional design. Future, prospective research should focus on these variables in clinical and community samples.

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## **THE RELATIONSHIP BETWEEN NEGATIVE LIFE EVENTS AND DEPRESSION: THE ROLE OF BASIC PSYCHOLOGICAL NEEDS IN COLLEGE STUDENTS.**

K. L. Walker, J. P. Hatfield, D. Dixon, P. C. Britton, and J. K. Hirsch, Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN.

Depression is a significant problem among college students, perhaps resulting in decreased social functioning, academic problems, and increased substance abuse. College students experiencing negative life events may be at greater risk for depression; however, not all students who report negative life events exhibit depression, possibly as a result of protective psychosocial characteristics, such as basic psychological needs. Autonomy, relatedness, and competence are components of basic psychological needs that when met help to improve functioning. Relatedness can be described as connectedness with others; autonomy is a sense of personal control over one's environment; and, competence can be viewed as the efficacy of one's own behaviors. We investigated the relationship between negative life events, basic psychological needs, and depression in college students. We hypothesized that greater levels of negative

life events would be associated with increased depressive symptoms, and that basic psychological needs would moderate this relationship. Our sample of 439 participants (71% female; 91% Caucasian; Mean Age=21.02, SD=6.11) was recruited from a rural Eastern university. Participants completed the Life Events Scale (LES), the Beck Depression Inventory-II (BDI-II), and the Basic Psychological Needs Scale (BPNS). At the bivariate level, negative life events were significantly positively associated with depressive symptoms ( $r=.281$ ,  $p<.001$ ). The BPNS total score and the autonomy, relatedness, and competence subscales were all significantly negatively correlated with depressive symptoms ( $r=-.615$ ,  $p<.001$ ;  $r=-.547$ ,  $p<.001$ ;  $r=-.483$ ,  $p<.001$ ;  $r=-.574$ ,  $p<.001$ , respectively). A multivariate regression model examining the three subscales of the BPNS (autonomy, relatedness, and competence) revealed that competence significantly moderated the relationship between negative life events and depressive symptoms ( $t=-2.167$ ,  $p<.05$ ; UnB=-.300 [SE=.139]); there was a significant trend for relatedness as a moderator ( $p = .067$ ). Students whose needs for competency and relatedness needs are being met report less depressive symptoms in the context of negative life events, in partial support for our hypothesis. Our results are consistent with prior findings indicating the importance of fulfilling basic psychological needs to maintain healthy psychological functioning. Relatedness, via social support, and competence, via self-efficacy, may reduce the impact of negative life events on psychological functioning. Limitations of our study include use of cross-sectional data and a college student sample; prospective research in community and clinical samples is needed. Our findings may have clinical implications for the development of interventions for the treatment of depression. Enhancing feelings of competence and relatedness, through encouragement of problem-solving abilities and development of interpersonal relationships, may be effective in reducing depressive symptoms.

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#### **WORDS-IN-NOISE (WIN) TEST NORMS FOR 6- TO 12- YEAR OLDS**

Jamie Weaver, Nicole Farmer, Avni Gandhi, Emily Shelburne, and Richard Wilson, Department of Communicative Disorders, College of Clinical and Rehabilitative Health Sciences, East Tennessee State University, Johnson City, TN

The Words-in-Noise (WIN; Wilson, 2003) test is designed to evaluate the word-recognition abilities of adults in the presence of background noise. The WIN is comprised of NU No.6 words (female speaker) presented in multitalker babble at seven signal-to-babble ratios (SNRs) from 24 dB to 0 dB in 4-dB decrements. The purpose of this study was to determine the normative scores for the WIN test for 6- to 12-year old children. Method: The subjects included 294 children, 42 in each of the 7 age groups and 24 adults with normal hearing (18-27 years). The protocol included (1) a hearing screening (500, 1000, 2000, and 4000 Hz) at 15 dB HL (ANSI, 2004), (2) 3, 35-word WIN lists (WIN-1, WIN-2, and WIN-3) presented to the test ear with the noise at 70-dB SPL and the words at 7 SNRs from 24 to 0 dB (94- to 70-dB SPL), (3) the 70 NU No. 6 words that compose the WIN presented in quiet at 90-dB SPL, and (4) the Peabody Picture Vocabulary Test, Form L (Dunn et al., 1979). All testing was completed in a relatively quiet location (less than 60 dB A) in the participating school facilities. Results: The WIN data from the individual listeners were quantified in terms of the 50% correct point calculated with the Spearman-Kärber equation (Finney, 1952). The percent correct at each of the 7 SNRs also was evaluated for each listener/condition. The general results are as follows: (1) the biggest change in recognition performance occurs between the ages of 6 and 7 years, (2) from 9 to 12 years performance is stable, and (3) performance in young adults (18-27 years) is 1-2 dB better than performance by the older children. On average, performance at the 50% point improved 0.3 dB between WIN-1 and WIN-2 and 0.3 dB between WIN-2 and WIN-3. The 0.3 dB differences is small when consideration is given the fact that each token in the Spearman-Kärber equation has a value of 0.8 dB (i.e., each 4-dB step has 5 words). Better performance was achieved by more children on WIN-2 than on WIN-1 (48.3% versus 39.1%) and on WIN-3 than on WIN-1 (57.8% versus 41.2%). The mean percent correct recognitions for the 70 NU No. 6 words presented in quiet was lowest for the 6-years group (93.1%) and asymptotic for the 8- to 12-years groups (98-99%). The adjusted Peabody scores ranged from 105.2 (6-year olds) to 112.3 (11-year olds). All mean scores were within the normal 85-115 range with 9 children scoring below 85. There was no relationship between performances on the Peabody and WIN. With adults, the cut-off (defined by the 90<sup>th</sup> percentile) for normal

50% performance is  $\leq$ 6.0-dB S/N. The 90<sup>th</sup> percentiles for children are higher and are as follows:  $\leq$ 13.2-dB S/N (6 years),  $\leq$ 10.0-dB S/N (7 and 8 years), and  $\leq$ 8.4-dB S/N (9 through 12 years). A couple of tables and a series of bivariate plots and the psychometric functions by age group will be used to depict the data.

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**EARLY RESPONSE TO HER2 OVEREXPRESSION IN POLARIZED CELLS INVOLVES  
PARTIAL SEGREGATION FROM HER3 BY RELOCALIZATION TO THE APICAL SURFACE  
AND INITIATION OF SURVIVAL SIGNALING.**

Robert Wood and Amber Pfister, Gatton College of Pharmacy, East Tennessee State University, Johnson City, TN

In several human cancers, HER2 overexpression facilitates the formation of constitutively active homodimers resistant to internalization which results in progressive signal amplification from the receptor, conducive to cell survival, proliferation or metastasis. Here we report on studies of the influence of HER2 overexpression on localization and signaling in polarized Caco-2 and MDCK cells, two established models to study molecular trafficking. In these cells, HER2 is not over expressed and shares basolateral localization with HER3. Over expression of HER2 by transient transfection resulted in partial separation of the receptors by relocalization of HER2, but not HER3, to the apical surface, as shown by biotinylation of the apical or basolateral surfaces. These results were confirmed by immunofluorescence and confocal microscopy. Polarity controls indicated that the relocalization of HER2 is not the result of depolarization of the cells. Biotinylation and confocal microscopy also showed that apical, but not basolateral HER2 is activated at tyrosine 1139. This phosphotyrosine binds adaptor protein Grb2, as confirmed by immunoprecipitation. However, we found that it does not initiate the canonical Grb2-Ras-Raf-Erk pathway. Instead, our data supports the activation of a survival pathway via Bcl-2. The effects of HER2 over expression were abrogated by the humanized anti-HER2 monoclonal antibody Herceptin added only from the apical side. The ability of apical HER2 to initiate an altered downstream cascade suggests that subcellular localization of the receptor plays an important role in regulating HER2 signaling in polarized epithelia.

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# Divisions IV and VI – Medical Students and Case Histories

## VIDEO INTERVENTION TO PROMOTE BREASTFEEDING IN A PRIMARY CARE SETTING

Blair Abelson<sup>1</sup>, Katie Barger<sup>1</sup>, and Twanda Waddlington<sup>2</sup>, <sup>1</sup>College of Medicine, <sup>2</sup>College of Public Health, East Tennessee State University, Johnson City, TN

**Introduction:** Breastfeeding has numerous benefits for babies, mothers, and families. It is well established that mothers perceptions of embarrassment, convenience, and social support related to breastfeeding affect whether they choose to breastfeed and for how long . Tennessee falls well below national statistics and goals for breastfeeding initiation and continuation. Effective and efficient promotional tools that can be incorporated into clinical care are needed. **Objectives:** This study evaluated the effectiveness of a video intervention to improve perceptions of breastfeeding among pregnant women presenting for a prenatal visit in an obstetrics and gynecology (OB/GYN) clinic in northeast Tennessee. Specifically, the project sought to determine whether watching the video with the babys father, a friend, or family member (supportive others) would be more beneficial than watching it alone, a previously unanswered question. **Methods:** The investigative team established a relationship with an OB/GYN clinic that serves a high volume of pregnant women. A 15 minute video addressing issues of embarrassment, convenience and support related to breastfeeding was shown in the clinic waiting room. The video had been previously developed and evaluated by the Mississippi Department of Health. Pregnant women visiting the clinic during 8 days in 2009 were invited to complete an anonymous written survey immediately before and after viewing the video. The survey included items on demographics, perceptions of breastfeeding, and intention to breastfeed. Descriptive statistics were calculated. The proportion of women reporting improved perceptions of breastfeeding was compared between subgroups using chi-square testing. Mean breastfeeding perception scores were compared between subgroups and changes in womens intention to breastfeed were evaluated. **Results:** Of the 77 participants, 38.9% reported previously breastfeeding a child, 51.3% planned to breastfeed, and 25% were undecided. After viewing the video, perceptions of embarrassment, convenience, and social support related to breastfeeding improved in a range of 39-44.2%, 37-40%, 39-63% of women, respectively. Mothers who watched the video with a supportive other were more likely to report improved perceptions of embarrassment than mothers who watched the video alone ( $\chi^2 = 12.01, p = .002$ ). Of the mothers who reported being undecided about breastfeeding prior to watching the video, 57.9% reported being more likely to breastfeed after watching the video ( $\chi^2=10.22, df=2, p=0.006$ ). **Discussion:** The findings suggest this video intervention is an effective means of addressing barriers to breastfeeding in the clinical setting. Furthermore, this study addressed previously unanswered questions about the impact of pregnant mothers watching the video with supportive others; results indicate that its efficacy is significantly improved if pregnant women view it with a supportive other.

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## WAIT BEFORE YOU KNOCK THEM DOWN.

George Abraham MD and Demetrio Macariola MD, Department of Pediatrics, Quillen College of Medicine, East Tennessee State University, Johnson City TN

**Objective:** Increase awareness of clinicians about appropriateness of using antibiotic when dealing with acute bacterial diarrhea. **History:** A 6 year old girl with recent diagnosis of acute otitis media, being treated with amoxicillin-clavulanate and hydrocodone presented to pediatric ER with a history of nausea, vomiting, diarrhea and fever of 104 F. She had a history of asthma and uses albuterol inhaler for wheezing. She is allergic to strawberries while her immunizations were up to date. Her review of systems is essentially normal. She has contact with a family member who had diarrheal illness. She lives with her

mother and uncle. They have a dog at home. They use city water for drinking.

Pertinent Physical Examination Findings: Vitals temperature 97.3F, heart rate 109/minute BP 107/64 mmHg, respiratory rate 26/min, oxygen saturation 99% room air, weight 18.5 kilograms. There was hyperemia of both tympanic membranes with bulging of right tympanum compared to the left while dryness was noted on her oral mucosa. There was no hyperemia of oropharynx. She had no heart murmurs while no rales, wheezing or rhonchi were heard on auscultation of her chest. Tenderness was noted on palpation over left upper and lower quadrants of her abdomen. The rest of her physical examination was essentially normal.

Pertinent Laboratories: Significant numbers of fecal leukocytes were noted from her stools. The comprehensive metabolic panel and complete blood count were unremarkable. From the stool culture *Shigella sonnei* was isolated which was shiga toxin positive.

Course in the Ward: On admission she received intravenous fluids for rehydration. After 24 hours she was well hydrated with her symptoms being resolved and was discharged home for close follow up. She did not receive antibiotics.

Discussion: Shigella is still a pathogen that is prevalent in the U.S. It is transmitted by the fecal oral route. Shigellosis is one of the most contagious bacterial infections that even only 10 bacteria can cause full blown illness. Vomiting along with watery or bloody diarrhea are the usual manifestations as in our patient. Shigellosis is usually self limited illness in immunocompetent host, with symptoms resolving after 48-72 hours. For self limited infection especially for shiga toxin producing *Shigella* as in our case no antibiotic treatment is needed as will predispose to hemolytic uremic syndrome. For severe infection however antibiotic treatment is necessary. Complications include reactive arthritis, rectal prolapse, toxic megacolon and seizures. From this case clinicians should realize that not all bacterial diarrheal illness should be treated with antibiotics as in our patient to prevent potential complication.

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### **TURNOVER OF CORNEAL EPITHELIUM VISUALIZED USING MOSAIC ANALYSIS WITH DOUBLE MARKERS (MADM)**

L.B. Bundon, P.D. Moore, J.D. Sword, D.M. Defoe, Department of Anatomy and Cell Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN.

The adult corneal epithelium is continually replaced as a result of proliferation and differentiation of tissue stem cells. While much has been learned about this process, the location of stem cells and the detailed mechanisms responsible for normal tissue homeostasis are still in doubt. In the present study, we have begun to trace epithelial renewal at the level of single cells using a genetic marking technique. For MADM, two reciprocally chimeric marker genes are targeted separately to identical loci on homologous mouse chromosomes. The chimeric marker genes consist of partial coding sequences for green and red fluorescent proteins (GFP and RFP, respectively) separated by an intron containing the loxP site. Following Cre recombinase-mediated interchromosomal recombination during mitosis, functional GFP and RFP are reconstituted resulting in two daughter cells each expressing one of the two fluorescent proteins upon G2-X segregation. In our experiments MADM reporter strains were crossed with either Hprt-Cre- or Krt14-Cre-expressing lines to target all mitotic cells, or only long-term progenitors, respectively. One of the advantages of this technique is that, since interchromosomal recombination is relatively inefficient, cell labeling occurs only sporadically, allowing the progeny of individual mitotic events to be readily identified. When whole-mounted corneas are examined by fluorescence stereoscopy, they exhibit a relatively high density of labeled cells in an annular zone at the edge of the cornea, co-extensive with the limbus. Emanating from this zone are linear arrays of cells extending from the tissue periphery to its central region. While similar to radial stripes seen in X chromosome-inactivation mosaics, these uninterrupted arrays consist of much smaller groups of cells arranged either in single-file or organized into thicker bands. In frozen sections, labeled cells are often seen across all layers of the stratified epithelium. Similar labeling patterns are observed with either type of Cre driver. These studies establish the efficacy of the MADM technique as a means to follow the life cycle of regenerating epithelial cells. While they support a role for limbal stem/progenitor cells during normal corneal development and maintenance, they do not exclude a parallel involvement of putative corneal stem cells.

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## **EFFUSIVE-CONSTRICITIVE PERICARDITIS MASKED BY BICUSPID AORTIC VALVE WITH DILATED AORTIC ROOT: AN UNUSUAL PRESENTATION OF CONGESTIVE HEART FAILURE**

Brian C Nyberg MS3, Justin R Moore MD, Department of Internal Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

We report the case of a 61-year old man with constrictive pericarditis (CP) who presented with chest pain and worsening dyspnea over several months and who was diagnosed with congestive heart failure and bilateral pleural effusions secondary to bileaflet aortic valve and aortic root dilation. Upon operation for this condition, however, it was discovered that he had CP and he underwent partial pericardectomy and drainage of right pleural effusion. Constrictive pericarditis (CP) refers to loss of elasticity of the pericardial sac due to scarring, with pathological changes of chronic inflammation. It causes impaired late-diastolic filling leading to heart failure without myocardial dysfunction. As reported previously<sup>1</sup>, although cardiac surgery has recently become one of the most common etiologies of CP in the developed world, cases defined as idiopathic CP are still seen. A 61-year old man presented to the emergency department with worsening dyspnea and decompensation of heart failure. He had a history of left ventricular hypertrophy with left ventricular ejection fraction of 55-60% on previous echocardiogram 2 months earlier that was notable for bicuspid aortic valve with dilated aortic root. Work up eventually included echocardiogram and heart catheterization, both of which demonstrated preserved left ventricular function without significant coronary artery disease. Chest computed tomography (CT) and magnetic resonance angiography (MRA) studies showed bilateral pleural effusions and again noted the dilated ascending aorta without evidence of dissection. Chest CT also noted a small pericardial effusion. Surgery for aortic root and valve repair was undertaken, but cancelled when the pericardium was noted to be thickened to 1 cm with dense adhesions to the epicardium. Diffuse inflammation and edema, including some hemorrhage, was seen. The pericardium was resected and eventually diagnosed by pathology as chronic fibrous pericarditis. Post-operatively, the patient experienced complete resolution of his heart failure symptoms. This case illustrates a unique presentation of constrictive pericarditis (CP). The concurrent finding of constrictive pericarditis with ascending aortic aneurysm is relatively uncommon, with only a few dozen similar studies recorded in the literature to date. In addition, the case highlights the difficulty of making the diagnosis of CP when CT and magnetic resonance imaging fail to detect abnormal pericardial thickening, considered by some to be the most important radiologic landmark for the diagnosis<sup>2</sup>. Therefore, maintaining a high clinical index of suspicion for CP is necessary when considering causes of diastolic heart failure so that cardiovascular magnetic resonance (CMR), which has been reported previously to have an excellent diagnostic accuracy<sup>3</sup> may be sought early in clinical work up.

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## **SPINAL EPIDURAL ABSCESS AS A COMPLICATION OF RHINOSINUSITIS- A CASE REPORT**

Brian C Nyberg MS III, Justin R. Moore MD, Winston Bokor MS IV, Patrick J. Macmillan, MD, Hetal Brahmbhatt, MD, Steve Loyd, MD. Department of Internal Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Spinal epidural abscess (SEA) is a rare (0.2 to 2 cases per 10,000 hospital admissions), usually pyogenic infection of the epidural space that requires prompt surgical intervention to avoid permanent neurological deficits<sup>1</sup>. We report a case of SEA that was diagnosed in a 76 year old female patient presenting with headache and back pain of insidious onset with mild fever. A preexisting history of migraine headaches and chronic back pain made the diagnosis more challenging and led the patient to delay seeking treatment. A 76 year old female with chronic back pain was admitted to the hospital complaining of a sudden change in the quality and severity of her chronic back pain that was unresponsive to opioid analgesics or benzodiazepines prescribed to her in a Kentucky ER 3 days earlier. She described an aching pain in the midline lumbar region with radiation to the hips bilaterally. She also noted minor numbness in the lateral toes of the left foot, and a low grade fever that she had not measured. The patient gave a history of chronic sinus infections with most recent sinus infection and mild cough treated with azithromycin and a penicillin injection 10 days prior to admission. Physical exam was notable for a low grade fever of 99.6 °F, pulse of

99 bpm, and blood pressure of 175/70 mm Hg without orthostasis. Laboratory tests including complete blood count and serum chemistry were significant for leukocytosis (13.9 mg/dL) and elevated ESR (Westergren sedimentation test) at 101mm/hr. Radiology imaging including computed tomography (CT) of the spine showed a paravertebral abscess on both sides of the spine at the L4-L5 level extending into the left psoas muscle. Neurosurgery was consulted and bilateral decompression of the spinal cord via L4-L5 total laminectomies/facetectomies was performed. An epidural abscess was excised and drained and the patient recovered with initiation of appropriate antibiotic therapy. This case describes SEA apparently resulting from rhinosinusitis. Cases of rhinosinusitis are usually viral in nature, with secondary bacterial infection occurring in only 0.5 to 2 percent of episodes<sup>2</sup>. Approximately 1/3 of cases have no identifiable port of entry, while the remaining 2/3 usually result from skin and soft tissue infections and complications of spinal surgery or other invasive procedures<sup>3,4,5,6,7</sup>. Spread to the central nervous system is a rare, but dangerous potential complication of bacterial sinusitis. A search of the literature reveals that most published cases of central nervous system complications resulting from rhinosinusitis are intracranial rather than spinal in nature. One meta-analysis of 915 patients with SEA found that 71% had back pain as an initial symptom and 66% had fever<sup>1</sup>. Staph aureus was the most common bacteria isolated. ESR was consistently elevated (average 77 mm in first hour) and MRI was the most effective technique for diagnosis<sup>1</sup>. Traditional treatment for SEA remains surgical drainage and antibiotic therapy, though some patients with epidural abscesses and only minor weakness at the initiation of treatment have been found to recover with aspiration for diagnosis plus antibiotic therapy alone<sup>8</sup>.

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#### **DELAYED DIAGNOSIS OF A CONGENITAL DISEASE – A COMPLICATED PRESENTATION OF HIRSCHPRUNG'S DISEASE**

Ranjit Philip, MD, James B. Osborne, Jr., MD, MBA; Jessica D Albright, BA; and Lesli A Taylor, MD, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

**CASE HISTORY:** :A sixteen-month-old Caucasian male presents to the emergency room with seizure-like activity, diarrhea and hyponatremia. After initial stabilization in the pediatric intensive care unit, a detailed history revealed fifteen loose brown foul-smelling stools. He was admitted with a diagnosis of gastroenteritis. He subsequently presented to an outlying emergency room with significant abdominal distension and pain. The CT scan at that time revealed a significantly dilated colon with a normal rectum. However, he was not diagnosed with Hirschprung's disease until two years later, at four years of age, when a detailed history revealed longstanding constipation which prompted a contrast enema study substantiating the diagnosis. He subsequently underwent an uncomplicated Duhamel procedure with adequate return of bowel function. **DISCUSSION :**(Objective): This case alerts community pediatricians to the rare but deadly complication of Hirschprung's disease presenting as enterocolitis. This could subsequently lead to severe electrolyte abnormalities and sequelae to include seizure-like activity. It also reiterates the importance of good history taking in that while constipation in children is common, one must keep Hirschprung's disease in the differential. If diagnosed and managed promptly and appropriately, patients have a good prognosis.

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#### **IT TAKES 2 TO TANGO: *S. PYOGENES* AND *S. PARASANGUINIS* CO-INFECTION IN AN 8 YEAR OLD.**

Stewart Stancil, MSIII and Demetrio Macariola, MD, Department of Pediatrics, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

**Objective:** To increase awareness of clinicians about unusual presentation of streptococcal infections. It is unusual for streptococcal infections to occur in one host simultaneously and cause jaundice as its manifestation. Here we present an eight year old boy with fever and generalized macular rash for five days later on developing jaundice and abdominal pain. He takes methylphenidate for attention deficit and

hyperactivity disorder. He had no history of dental procedures. The family has a dog, cat and hamster as pets. He has no known allergies. PE findings were pertinent for temperature of 100.8 F. Generalized macular rashes. Icteresia was noted on the sclerae. There was no hyperemia of the oropharynx. No heart murmur was appreciated. Tenderness was noted in the right upper quadrant. Laboratories were significant for elevated total bilirubin of 3.2 mg/dl and direct bilirubin of 2.2 mg/dl. AST, ALT and alkaline phosphatase levels were elevated at 55 iu/ml, 121 iu/ml and 532 iu/ml, respectively. Serologies for Leptospira, EBV, Rocky Mountain Spotted Fever, and Hepatitis viruses were negative. An ultrasound of the abdomen revealed sludge in the gallbladder while HIDA scan revealed obstructive process in the cystic duct. From his blood culture *Streptococcus parasanguinis* was isolated which was susceptible to cefotaxime and ampicillin. Likewise, his rapid streptococcal screen was positive and *S. pyogenes* was isolated from his throat culture. He was treated with ursodiol and was placed on a fat-free diet. He gradually improved during his hospital stay. He was treated with IV cefotaxime and oral amoxicillin for 14 days. On follow up a week after discharge he had desquamation of his palms and soles. Streptococcus species are well known pathogens to humans. *Streptococcus pyogenes* can cause necrotizing and toxin mediated infection along with sepsis and bacteremia while *Streptococcus parasanguinis* had been implicated to cause bacteremia and endocarditis. Our case is unique in the sense that our patient had simultaneous infections with these 2 streptococcal pathogens causing abnormalities of the hepatic and biliary system, an unusual manifestation of streptococcal infection. Clinicians should therefore be aware of these phenomena when treating children with streptococcal infection.

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# Division V – Residents and Post-Doctoral Fellows

## THE NOT SO COMMON CASE OF ENDOCARDITIS

Vedang Bhavsar MD, Justin Moore MD, Fagun Modi MD, Hetal Brahmbhatt MD, Rakesh Patel MD, and Patrick Macmillan MD, Department of Internal Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Candida infective endocarditis is a rare and poorly understood complication of fungemia. Approximately 1.3% to 6% of all endocarditis cases are of fungal origin[1-2]. Fungal endocarditis is the most severe form of infective endocarditis and has the worst prognosis. Despite aggressive antifungal and surgical therapy, mortality approaches 80% in some series[3-4]. A 70 years old caucasian male with a four month ago history of sternal wound candidiasis after mitral valve replacement and negative for candidemia at that time presented this time with fever, shortness of breath. Vitals were notable for fever of 101.2 degree F, pulse of 84 bpm and blood pressure of 97/59mmHg. On physical exam, he was confused, sleepy, disoriented, tachypneic and moderately distressed. He had heart murmur and right-sided lung crackles. Laboratory tests including complete blood count and serum chemistry were significant for leukocytosis and elevated ESR (Westergren sedimentation test) at 101mm/hr. Trans Thoracic Echocardiogram showed aortic and mitral mechanical valve with wall dehiscence and ring abscess of mitral valve. He was started on IV Vancomycin and Zosyn. On subsequent days, his blood cultures grew candida albicans and was started on Amphotericin B. He was not a surgical candidate secondary an extremely high risk of mortality. The first report of fungal species as the infective agents after a mitral valve replacement was by Newman and Cordell in 1964. The common infectious agents are Candida Albicans (60-67%) and Aspergillus Fumigatus [5]. Candida IE is an uncommon but frequently fatal infection [6]. Important risk factors or predisposing conditions for fungal endocarditis are previous surgery, vascular lines, antibiotic use, underlying heart disease, prosthetic valves and immunocompromising conditions. The increase in hospital-acquired Candida IE is consistent with the recent data describing Candida as an emerging nosocomial bloodstream pathogen over the past decade [7]. The clinical findings and presentation of patients with Candida and non-fungal IE are very similar [8]. Embolic phenomena due to large valvular vegetations are also common in cases with fungal endocarditis [9]. The crude survival of fungal endocarditis had increased over the past 20 years, from 14% before 1970 to 41% during 1991-1995. Possible reasons for this improved survival were attributed to better echocardiogram techniques, earlier diagnosis of endocarditis, or better supportive care of ill patients. The traditional antifungal treatment of Candida IE is Amphotericin B (6-8 weeks), often followed by fluconazole as suppression because of frequent relapse. In addition, surgical intervention with valve replacement is generally recommended in most cases.

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## USE OF VOIDED URINE AS CONTROL MATERIAL FOR ANTI-BK VIRUS IMMUNOHISTOCHEMICAL STAINING

Yasmin Elshenawy, MD, James M. Ferris, MD, Johanna Preiszner, and George A. Youngberg, MD.  
Department of Pathology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

“I am interested in knowing how you solved the BK control problem”. It is a common frustrating problem in most renal transplant pathology services. Polyomavirus (BK virus) can cause severe tubulointerstitial nephritis, potentially leading to graft loss. Detection and confirming BK virus infection in kidney biopsies using immunohistochemical stains (IHC) is essential to prompt therapeutic intervention. The unavailability of BK virus IHC control material is attributed to the limited tissue available in a kidney needle biopsy and to limited commercial supplies. On our renal biopsy service to overcome this problem, we successfully implemented a new method to generate positive controls using a voided urine specimen from a patient with BK viremia previously diagnosed by serum PCR testing. Urine samples were centrifuged down to pellets,

washed with phosphate buffered saline (PBS), then combined and re-suspended in PBS to create 5 mL of a concentrated cell suspension. The pellet was mixed 1:1 with HistoGel, fixed in formalin and finally processed into paraffin-embedded cell blocks. Fifty cell blocks were obtained from the original urine sample. Freshly cut slides were stained with a mouse anti-BK virus large T antigen monoclonal antibody (dilution 1:2,500 in PBS). Positive cells (approximately 10/section) depicted a brown nuclear stain visible on light microscopy. The generated method has proven to be helpful in our laboratory for the production of control tissue sections for BK virus IHC. The cellularity of the single-shift urine sample provided us with a generous amount of centrifuged cellular material (50 blocks). While tissue from renal biopsies represents a more conventional resource for control sections, any positive biopsy used as a control is soon cut through, so a reliable source of control material cannot be maintained. Retrieving cytologic material from urine can be a readily accessible, non-invasive source of positively staining cells for IHC control purposes.

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### **CALCULATION OF UTERINE WEIGHT BASED ON TRANSVAGINAL ULTRASOUND MEASUREMENTS**

Brooke E. Foulk, MD, Howard E. Herrell, MD, Department of Obstetrics and Gynecology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Accurate estimations of uterine size are important for the preoperative evaluation of patients, and may affect planning the surgical route of hysterectomy. Clinical exam has mostly given way to 2-dimensional ultrasound assessment of uterine volume, and size as a calculated value. There are traditional formulas to calculate uterine volume and thus extrapolate uterine weight. The accuracy of these equations is based on assumptions made regarding uterine shape, the accuracy and precision of ultrasound measurements, and the density of uterine tissue. We sought to determine a new coefficient that more accurately predicts the uterine weight at pathology and determine this new equation's reliability. We performed a retrospective analysis of our Department's recorded hysterectomies from Jan. 2008 through Dec. 2009. Over the two year period, we collected data from a chart review including uterine length and height in the sagittal plane and width on transverse plane from ultrasound reports, as well as pathologic reports of actual uterine length, width, height, endometrial thickness, and weight. We included all patients for whom all the necessary data was available, and we excluded some who underwent morcellation since both the pathology and ultrasound measurements were unreliable for larger uteri. For the same reason, we excluded uteri >400 grams. All ultrasounds were performed transvaginally. Route of hysterectomy was documented along with pathology type, but did not affect inclusion in the analysis. Ultrasounds were performed by multiple individuals using standardized technique. Using the formula, Weight=CxLxHxW, the coefficient (C) was calculated for the L, H, and W for the ultrasound and pathology data. Predicted weights were then calculated for all cases based on original ultrasound data; these predicted values were compared to actual pathological weights. The reliability of ultrasound for predicting actual weight with this new coefficient was then determined. A total of 144 cases met our inclusion criteria. A coefficient of 0.584 was calculated for the ultrasound measurements and 0.421 was calculated for the pathology measurements. The ultrasound coefficient yielded a result within 20% of the actual weight in 62% of the cases, whereas the pathology coefficient (with pathology measurements) yielded a result within 20% of the actual weight in 57% of the cases. We found that a coefficient of 0.584 may more accurately reflect the shape of the uterus as it deviates from a true ellipsoid. Prediction of uterine weight becomes less accurate with increasing size of the uterus (i.e. more shape irregularities due to fibroids). Fibroids also would tend to make the specimen denser. Weaknesses in our data set include minor variations in ultrasound technique among sonographers and the timing between ultrasound and hysterectomy (whereby treatment may affect uterine size). We believe the pathology coefficient is markedly lower due to rounding-up tendencies in the measurements and total uterine lengths made longer in vitro because of the unflexed cervix. A larger, prospective trial, controlling for these and other variables is needed before a more accurate coefficient can be determined.

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## **TRANSCUTANEOUS CLOSURE OF PFO: A SAFE AND EFFECTIVE ALTERNATIVE FOR SECONDARY STROKE PREVENTION.**

A. D. Garcia, MD; R. Kuriacose, MD, Department of Internal Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Learning Objective: To be aware of Transcutaneous closure of PFO as a safe and effective alternative for secondary stroke prevention.

Case presentation and discussion: Patent foramen ovale a congenital cardiac lesion is a frequent finding on echocardiography and occurs 25 to 30 percent of individuals (up to date). Most patients with a PFO remain asymptomatic however the most important clinical manifestations is ischemic stroke. The prevalence of PFO is much higher in patients with cryptogenic stroke, particularly those under age 55. Paradoxical embolism due to the presence of patent foramen ovale (PFO) is a well-established possible mechanism of cryptogenic stroke (stroke of unknown origin). Therapeutic options for secondary stroke prevention in patients with PFO include medical therapy with antiplatelet agents or anticoagulation, and surgical or percutaneous closure of the defect. To date there are insufficient data to support a benefit of warfarin over aspirin in preventing recurrent stroke in most patients with PFO and comparison of medical and endovascular closure of PFOs in patients with stroke is ongoing. Transcatheter closure of PFO is safe, effective and related with mild complications. This procedure may become the treatment of choice in patients with the highest risk of recurrent ischemic stroke and doesn't want to be on anticoagulation. We present a case of 50 year old male, overweight, smoker with no significant past medical history and not taking any medications who presented with brief episode of speech disturbance associated with right cheek numbness was found to have ischemic stroke in the setting of PFO. Work up for significant intra and extra cranial occlusive vessel disease, cardiac dysrhythmia and coagulation study was negative. Patient was initially placed on warfarin for secondary stroke prevention however patient opted to undergo transcutaneous closure of his PFO. Endovascular PFO closure with the use of Amplatzer septal occluder was done without any complications. Patient was then continued on aspirin 325mg daily. At one year follow up patient has no interval events suggestive of recurrent stroke or TIA and TEE showed no evidence of residual shunting.

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## **COMPARISON OF AUTOMATED BLOOD PRESSURE READINGS IN THE FOREARM AND UPPER ARM OF PREGNANT WOMEN**

Stephanie Gibson, MD; Howard Herrell, MD; and Jessica Demay, MD, Department. of Obstetrics and Gynecology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Blood pressure is measured routinely in pregnant women to screen for gestational hypertension and pre-eclampsia. It is essential that blood pressure measurements are accurate in order to avoid over-treatment and possible hospitalization or delivery of normotensive women. Some healthcare workers have been noted to routinely measure blood pressure in the patient's forearm, especially in patients who are wearing bulky clothing or whose upper arms are too large for the available cuff size. The purpose of this study was to determine if there is a difference in the blood pressure measurements obtained in the forearm compared to the upper arm of the same patient, specifically, pregnant women. The study population (n=197) was comprised of all adult pregnant women presenting to ETSU Ob/Gyn for prenatal visits during the test period. This included patients who were normotensive, known hypertensive, and those with other chronic conditions, including diabetes. The patient's blood pressure was taken with an automated sphygmomanometer in the upper arm using the appropriate size cuff, as per the clinic's usual routine. The measurement was then repeated in the forearm of the opposite arm, with the forearm positioned resting on the patient's lap. Only the upper arm measurement was considered in any clinical decision-making. The upper arm and forearm measurements were then be compared statistically using a Student's t-test, a Bland-Altman plot, and linear correlation coefficient to determine whether or not there was a significant difference between the two measurements. The t-test showed a mean difference of 13.4 mmHg systolic BP (95%CI 12.2, 14.6) and 7.5 mmHg diastolic BP (95%CI 6.0-9.0), p<0.0001 for both. The Bland-Altman plot yielded the same mean differences with a 95%CI for limits of agreement: systolic (-3.4, 30.2) and diastolic (-6.9, 22.8). The linear correlation showed weak correlation ( $r=0.36$ ) for diastolic BP and a

moderate correlation ( $r=0.75$ ) for systolic BP. These combined statistical analyses suggest that blood pressure measurements in the upper and lower arms of pregnant women should not be used interchangeably. Only upper arm measurements of blood pressure should be used for diagnosis of hypertensive disease in these patients. The lower arm measurement was higher in most patients, and the broad range of the limits of agreement (Bland-Altman plot) suggests that hypertensive disease would be over-diagnosed in many cases based on measurements taken in that manner.

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### **OUT OF SIGHT , BUT NOT OUT OF MIND- SALMONELLA TYPHI**

Jaspal Hothi MD and Demetrio Macariola MD, Department of Pediatrics, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Objective: To make clinicians aware about the possibility of recurrence of salmonella typhi infection in children treated adequately with ceftriaxone. An 8-year-old male just returned from travel to Southeast Asia, developed a diarrheal episode and decreased appetite, while on travel. He was treated with metronidazole, completing the 7 day course with improvement. After he returned home, to the US, he developed nausea, vomiting, fever, increasing lethargy, diarrhea and decreased appetite. He was admitted to an outlying facility and his laboratory test results revealed low WBC counts, elevated AST and ALT. KUB showed a large liver with ultrasound of the liver revealing a starry-sky liver. From his blood culture, gram-negative rods were isolated. He was started empirically with ceftriaxone and was transferred to our hospital. PMH: No previous hospitalization and surgical interventions. Review of System was all negative. Pertinent PE findings T: 100.2F HR 100 BP 100/70. No cardio-respiratory distress. Examination of his abdomen revealed diffuse tenderness while the rest of the physical examination was unremarkable. While he was hospitalized in our facility, ceftriaxone was continued along with metronidazole. From his repeat blood culture at our hospital, *Salmonella typhi* was isolated that was susceptible to ceftriaxone and ciprofloxacin. No salmonella was isolated from his stool. CT abdomen showed pericholecystic fluid. He was treated with intravenous ceftriaxone for 14 days and clinically improved with subsequent blood culture being negative for *S. typhi*. He returned back to our hospital after 2 months with a fever, profuse sweating, abdominal pain and vomiting. On exam, his vitals signs revealed a temperature of 101.2F, HR 110/minute, BP 110/70 mm Hg. Abdominal tenderness was again noted on his right lower quadrant. From his blood culture, *Salmonella typhi* was isolated again and which was still susceptible to ceftriaxone and ciprofloxacin. Ultrasound of gallbladder was negative for stones. He was retreated with ceftriaxone and azithromycin with slight improvement. His antibiotic was changed to oral ciprofloxacin and rifampin this time with dramatic improvement. These two antibiotics were continued for total course of 21 days.

Discussion: *Salmonella typhi* is a common cause of enteric fever in individuals who have a history of international travel to endemic areas in the world, such as Southeast Asia. *S. typhi* infection may recur even with appropriate antibiotic treatment as depicted in our case because these bacteria can invade monocytes surviving while inside the monocytes, hence making these cells a protective shield from antibiotics. Flouroquinolones have been shown to penetrate monocytes compared to other antibiotics. This could be the possible reason why our patient improved when treated with this antibiotic. This case emphasizes the importance of being aware of a recurrence of *Salmonella typhi* infection in children even with adequate antibiotic treatment. It is therefore imperative that individuals with salmonella should be followed closely for possible recurrence.

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### **A SPECIFIC CAUSE FOR NON-SPECIFIC SYMPTOMS – A CASE OF HYPERVITAMINOSIS D**

Nerissa Licup MD; Sai Prasanna Mannem MD; Reena Kurianose MD., Department of Internal Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Here is a case of hypervitaminosis D, presented to help clinicians be aware of the possibility of Vitamin D toxicity with use of supplements, discuss signs and symptoms of Vitamin D toxicity and to be aware of mistakes that can happen when refilling prescriptions. A 78-year old female with history of depression, anxiety and mild dementia presented with worsening apathy, anorexia, irritability, nausea, vomiting, bone

pain, constipation, polydipsia and backache. Physical examination was unremarkable. Basic labs were within normal limits except for elevated calcium at 11mg/dl. On review of her medical records, she was on Klonopin, Caltrate, Zoloft and Vitamin D 50,000 IU every week started a year ago for vitamin D deficiency by her previous physician. On further verification the patient confirmed that she was taking 50,000 IU of Vitamin D on a daily basis. Vitamin D levels were noted to be 315ng/ml. The Caltrate and Vitamin D were stopped and her Vitamin D and calcium levels were monitored. One month later calcium was 10mg/dl, and 3 months later Vitamin D was 81ng/ml. A year later Vitamin D was 48ng/ml. Her symptoms resolved slowly as levels dropped to within normal limits. It was found that a nursing staff had called in a daily dose while renewing the refills. Vitamin D exists as both D2 and D3 with equal biologic potency in humans. It maintains calcium balance in the body through the bone and intestines. Current recommended upper limit of Vitamin D is 50 ug or 2000 IU/day. Although, evidence has shown that Vitamin D levels of 250/ug/day (10,000 IU/day) have shown no toxicity. Hypervitaminosis presents with increase in calcium levels resulting in symptoms related to hypercalcemia such as lethargy, weakness, dizziness, confusion and renal failure. An increasing urinary calcium/creatinine ratio may be an early indicator of hypercalcemia. Women aged above 65 may be more susceptible to hypervitaminosis D. Milder cases can be treated conservatively with discontinuation of the Vitamin D and calcium supplements. Others may require hydration, steroids and diuresis. Physicians should be aware of the signs and symptoms of Hypervitaminosis D. Vitamin D levels should be monitored in patients on supplements. Care should be taken in prescribing and refilling the correct doses of any medication including supplements.

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### **THYROID DYSFUNCTION IN PATIENTS WITH HEPATITIS C RECEIVING INTERFERON THERAPY**

Sai Prasanna Mannem, Nerissa Licup, and Reenea Kurriacose, Department of Internal Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

A 48 year old female with subclinical hypo-thyroidism (TSH 6.29, Free T4 1.08) on low dose thyroid supplements for symptoms of fatigue, was found to have Hepatitis C. Viral load 4860000 copies/ml, genotype 1B. Alpha Interferon and Ribavarin therapy was started. TSH levels gradually went up to 93, and her Synthyroid dose was accordingly increased from 25 mcg to 112 mcg in six months. Anti-peroxidase antibody titer was 110.7. After completion of her Interferon therapy the TSH levels trended down in three months and the Synthyroid dose was tapered to 88mcg. Here we try to illustrate the importance of thyroid surveillance in all patients with Hepatitis C before, during and after Interferon therapy and to recognize different patterns of thyroid abnormalities in these patients. Thyroid disorders are common in patients with chronic Hepatitis C infections. In addition, many patients with Hepatitis C develop thyroid abnormalities with Interferon therapy. The commonest is De Novo anti-thyroid antibodies without clinical disease (5-15%). 5-10% develop clinical thyroid disease including painless thyroiditis, Hashimoto's or Grave's diseases. Hypothyroidism is twice as common as hyperthyroidism in such patients. The risk of thyroid dysfunction is greater in females and in those who have positive anti-thyroid antibody prior to initiation of Interferon therapy. Hence it is important to monitor the thyroid function in patients with Hepatitis C especially when they are undergoing treatment with Interferon.

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### **THE ACCURACY OF CURRENT THYROID FUNCTION SCREENING IN PREGNANCY**

Camile Marsh<sup>1</sup>, John Kalbfleisch<sup>2</sup>, David Schmidt<sup>3</sup>, and Kevin Breuel<sup>1,3</sup>.

<sup>1</sup>Department of Obstetrics and Gynecology, <sup>2</sup>Office of Academic Affairs and <sup>3</sup>ETSU Clinical Labs, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Thyroid stimulating hormone (TSH), alone or in combination with free thyroxine (FT4) are considered to be the "Gold Standard" test(s) for the initial evaluation of thyroid function. During normal pregnancy, various physiological and hormonal changes occur that are known to alter thyroid function. Specifically, increased production of thyroxine-binding globulin (TBG) during pregnancy, results in an increase in the

circulating amounts of total thyroxine (TT4) and total triiodothyronine (TT3) measured in the blood. However, since T4 is only active in its free form, it is imperative that clinicians who are taking care of pregnant patients have an accurate way to measure FT4. The objective of this study was to determine whether direct measurement of FT4 using an automated immunoassay adequately reflects the changes occurring during pregnancy as established by a traditional approach routinely used to estimate FT4, the Free Thyroxine Index (FTI). One-hundred and twenty previously analyzed samples from healthy pregnant (15 - 20 weeks of gestation, n=60) and non-pregnant (n=60), age-matched (18 – 35 yrs), Caucasian females were retrieved from storage (-80°C freezer) for this study. Samples were blinded to study investigators and then TSH, FT4, TT4, Thyroid Peroxidase (TPO) and T-Uptake were measured using the Immulite<sup>®</sup> 2000 chemiluminescent assay system. FTI was calculated using the following formula (TT4 \* T-Uptake). Differences between pregnant and non-pregnant thyroid hormone mean levels were assessed using the t-test. A *p* value of < 0.05 was considered statistically significant. The number of TPO antibody-positive patients in the pregnant (5/60) and non-pregnant (4/60) groups were similar and excluded from further analysis. Mean concentration of TSH ( $1.52 \pm .98$  and  $1.79 \pm 1.15$  mIU/ml) and the proportion of patients with normal TSH levels (53/55 and 53/54) were similar between the pregnant and non-pregnant group's, respectively. As expected, the mean concentration of TT4 was elevated (*p*<0.01) in pregnant patients ( $10.00 \pm 1.94$ , mg/dL) as compared to the patients in the non-pregnant ( $8.16 \pm 2.00$ ) group. However, no differences in the percentage of patients with abnormal TT4 levels were observed between the pregnant (16%) and non-pregnant (6%) groups. Mean concentration of FT4 (.85 ± .13 and  $1.00 \pm .23$ , ng/dl) and %T-Uptake (22 ± 2 and  $28 \pm 6\%$ ) was lower (*p*<.01) and the percentage of patients with abnormal levels of FT4 (67% and 26%) and T-Uptake (65% and 15%) were higher (*p*<.01) in the pregnant as compared to non-pregnant groups, respectively. Interestingly, no differences were observed in mean levels of FTI between the pregnant ( $2.2 \pm .4$ ) and non-pregnant ( $2.3 \pm .6$ ) groups. In conclusion, based on our findings levels of FT4, measured by direct immunoassay may not accurately reflect the thyroid status in pregnant patients and should be used in concert with other available tests to assess thyroid function.

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### **CARCINOMA FROM SOMEWHERE? CARCINOMA ANYWHERE? CARCINOMA FROM THE LIVER, THANKS TO TTF-1!**

Manisha Mishra, MD; Vickie Morgan, MD; Agnes Hamati, MD; and Mousa Al-Abbadia, MD., Departments of Pathology and Hematology/Oncology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Carcinoma of unknown primary (CUP) is not uncommon, and poses both diagnostic and therapeutic challenges. Recent developments in immunohistochemical (IHS) stains in diagnostic pathology help resolve many of these clinical dilemmas. Antibodies against Thyroid Transcription Factor (TTF-1), a relatively new and organ specific marker that stains lung and thyroid malignancies, is commonly included in the first battery of stains when dealing with an unknown primary . The usual pattern of staining for TTF-1 is purely nuclear. However, it was recently noticed that TTF-1 stains the mitochondria of benign hepatocytes and tumor cells in hepatocellular carcinoma . We would like to report 2 cases that we had in the last year where the clue to the hepatic origin of 2 carcinomas was the presence of cytoplasmic staining for TTF-1. Description of these 2 cases with pertinent literature review will be offered.Two patients were seen at the James H. Quillen VAMC where one had a right chest wall mass with previous history of prostatic carcinoma and the other was found to have a lytic rib lesion with a previous history of lung squamous cell carcinoma. FNA and core biopsies were performed on both lesions where the initial pathological interpretations were non-small cell carcinoma. IHS revealed positivity for cytokeratin-7 and granular cytoplasmic staining for TTF-1. Further workup using stains for Alpha Fetoprotein, HepPar-1 and CEA-p confirmed the diagnosis of metastatic hepatocellular carcinoma. Paying attention to cytoplasmic staining for TTF-1 in any CUP should prompt further pathological and clinical evaluation to rule out hepatocellular carcinoma.

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## B12 DEFICIENCY LEADING TO NEUROPSYCHIATRIC DISTURBANCE

Deidre M Pierce, MD , Jen Chavis MS IV, Justin R. Moore, MD, Patrick J. Macmillan, MD, Hetal Brahmbhatt, MD, Steve Loyd, MD, Amapola Garcia, MD, Somi Rikhye, MD, and Sherrill Stockton, Ph.D, MS I, Department of Internal Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Our patient in this case study is a 42 year old female admitted for altered mental status including auditory and visual hallucinations. The patient recalled problems with concentration, memory, balance, and gait for one year, but it had become increasingly worse over the past month, and the last two weeks unbearable. The symptoms of confusion, forgetfulness, headaches and lack of concentration had increased as to impair her personal and professional life as a restaurant manager. Also present were fatigue and weakness with the onset of anxiety and depression as this symptom constellation developed. Other symptoms included sore, burning tongue, and recent onset of urinary incontinence. She also noticed she had developed bilateral lower extremity numbness, causing frequent stumbling. Once admitted, the patient had a syncopal episode with loss of consciousness, but no traumatic injury. She had no contributing past medical nor psychiatric history, and her significant family medical history included Type 2 Diabetes Mellitus, strokes and hypertension. She denied tobacco, alcohol, or illicit drug use; however, she did consume a near vegetarian diet. She did not use any chronic medications. On physical exam, our patient displayed both resting and intention left upper extremity tremors. Strength on the left was decreased compared to right side of her body. She had decreased patellar and Achilles reflexes of the left lower extremity but no wasting, fasciculation, or drift. Vibratory and joint sensation was absent in both feet, but no deficits were evident in her hands. Decreased cerebellar function was demonstrated by impaired rapid alternating movements. On admission, pertinent lab values included hemoglobin of 12.4, MCV of 106.7 and RDW of 28.8. The vitamin B12 level was <50 mcg, the lowest detectable value. Other labs obtained during the patient's work up included increased homocysteine level of 45 and methylmalonic acid level of 29. Interestingly, her anti- intrinsic factor was also positive. Urine drug screen was negative and blood glucose was within normal limits. An MRI of the patient's brain ruled out any anatomical etiology and revealed no significant disease. An echocardiogram was performed to rule out a cardiac etiology of her syncopal episode. The echocardiogram showed normal ejection fraction, trace mitral regurgitation, and diastolic dysfunction, with other aspects essentially normal. The patient displayed a constellation of neurological and psychiatric syndromes suggestive of a vitamin B12 deficiency. Imaging including MRI and an echocardiogram ruled out anatomical and cardiac etiologies, respectively. Based on lab data, our patient had a macrocytic anemia with anisocytosis. Further testing revealed a profoundly decreased vitamin B12 level and increased homocysteine level and methylmalonic acid level suggestive of a true vitamin B12 deficiency. An autoimmune etiology for this deficiency was later explored and her anti-intrinsic factor was positive. Our patient was therefore diagnosed with pernicious anemia and after being deemed stable for discharge was educated on how to administer vitamin B12 injections and advised to administer these subcutaneously at 1000mcg daily over the following two weeks, then weekly for one month. Subsequently, she would require a monthly maintenance dose.

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### BEWARE! RESURGENT NEONATAL INFECTION IN EUROPE, IT'S HERE IN THE USA: L. MONOCYTOGENES MENINGITIS ON A 23 DAY-OLD NEWBORN.

Eunkyoung Song, M.D., and Demetrio Macariola, M.D., Department of Pediatrics, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Objective: To increase knowledge of clinicians about *L. monocytogenes* as etiologic agent of sepsis and meningitis in the newborn. Case: A 23-day-old Caucasian female newborn presented with a 1-day history of fever associated with irritability and non projectile vomiting. She was delivered by repeat caesarian section at 38 weeks age of gestation with birth weight of 3.2 kilograms, to a 24-year-old mother. Her mother had uncomplicated pregnancy except for UTI that was adequately treated. She had one hepatitis B immunization and has no known allergies. She was in contact with her sister who had recent viral upper respiratory tract infection. Physical examination findings were pertinent for temperature of 100.5°F, heart rate of 165/minute, RR 30 breaths/min, BP 100/49 mm Hg. Weight 3.4kg (25-50%), Height 21inches (25-

50%), HC 35.5cm (50%). There was no bulging of her fontanels. The pupils were equally reactive to light. Adventitial sounds were noted on auscultation of her chest while no heart murmur was appreciated. There were no neurologic deficits noted. Pertinent Laboratory findings: WBC  $28.4 \times 10^3/\text{mm}^3$ , Hemoglobin 14.3g/dL, Platelet count  $677 \times 10^3/\mu\text{L}$ , Differential count N 70%, L 21%, M 6%, B 3%, CSF findings Protein 421mg/dL, Glucose 7mg/dL, WBC 1372/mm<sup>3</sup> (PMN 75%, Lymph 25%), RBC 89/mm<sup>3</sup>, Negative of Agglutination studies. Gram stain of CSF shows gram positive rods. *Listeria monocytogenes* was isolated from CSF. She gradually improved during her hospital stay. She completed 21 days of IV ampicillin and amikacin. Discussion: *L. monocytogenes* is one of the three major causes of meningitis in neonates. In recent years an increasing rate of *listeriosis* had been reported in several European countries. Clinical manifestations may be very similar to those seen with GBS disease, and there is a high fatality rate (3% to 50%). *L. monocytogenes* is a food-borne pathogen causing severe and life-threatening infections mainly septicemia, CNS infections (meningitis and meningoencephalitis) and abortions. *Listeriosis* occurs primarily at risk groups of population like elderly people, pregnant women, neonates and patients with underlying diseases or impaired cellular immunity. *L. monocytogenes* always are resistant to cephalosporins. Therefore, ampicillin in combination with gentamicin should be used for treatment. Trimethoprim-sulfamethoxazole can be used as second line of antibiotic treatment for *Listeria*. Lessons for Clinicians: Clinicians should be cognizant of the fact *L. monocytogenes* can cause life-threatening infection in newborn and clinicians should have high index of suspicion for it to prevent morbidity and mortality.

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## AN INSTITUTIONAL REVIEW OF ABDOMINAL MYOMECTIONY

Ross R. Spires, D.O. and Norman A. Assad, M.D., Department of Obstetrics and Gynecology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

The purpose of this project was to examine the methods used for myomectomy by three attending physicians at East Tennessee State University, Department of Obstetrics and Gynecology. After examining the charts of patients over the past 10 years, the different techniques (pretreatment and intra-operative) and outcomes (intra-operative or immediate postoperative) were compared. The study is a retrospective case series, with an N=32, that examined the indications for surgery, medical pretreatment, surgical approach, intra-operative blood loss, technique, operative time, inpatient post-operative complications, and post-operative length of stay. Inclusion criteria for the case series were all women who underwent abdominal approach myomectomy by an ETSU attending over the past 10 years. Exclusion criteria were women who underwent laparoscopic or vaginal myomectomy, those women who were operated on by an attending outside the ETSU system, and women under the age of 18. After examining these parameters, the different attending physicians' approaches were summarized and compared. The approaches to pretreatment of the patient included: no pretreatment and Lupron, a GnRH agonist. Indications for the procedure included: infertility and symptomatic fibroids. Surgical approaches included: abdominal approach with and without use of ultrasonic scalpel, use of vasopressin, and all surgeons used copious irrigation and multilayer closures. Starting hemoglobin, post-operative hemoglobin, and blood loss were compared and differed with surgical approach. The N was too small to show statistical significance. Operative time and length of stay were averaged amongst the 3 physicians and were comparable. There were only two minor post operative complications. The summary of the results can help us understand the approach and technique that the ETSU OBGYN residents are being exposed to. The findings can also help us to further study and quality improve myomectomy at ETSU. Further study with a larger N needs to be performed to show statistical significance in blood loss when using ultrasonic scalpels.

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## **SYSTEMIC ONSET JUVENILE IDIOPATHIC ARTHRITIS AND CYSTIC LYMPHATIC MALFORMATIONS IN A TODDLER- A PUZZLING COINCIDENCE?**

Melissa Snyder, M.D.<sup>1</sup>, Thomas M. Yohannan, M.D.<sup>1</sup>, Roger Smalligan, M.D, MPH.<sup>2</sup>, and Gayatri Bala Jaishankar,M.D.<sup>1</sup>

<sup>1</sup>Department of Pediatrics, East Tennessee State University, Johnson City, TN

<sup>2</sup>Department of Internal Medicine, Texas Tech University Health Sciences Center, Amarillo, TX

**Case report:** A 3 year old Hispanic male presented with fevers, skin rash, left neck swelling and refusal to walk of several days duration. Physical exam revealed a febrile, fussy toddler with a tender, cystic lesion in the left submandibular region. Both ankles had tender cystic lesions on the lateral malleolar regions. Labs: WBC 33,000 with neutrophilia, bandemia, thrombocytosis, and increased ESR and CRP. MRI of the neck and ankles revealed cystic lymphatic malformations with no communication with the joints. ENT specialist was consulted and neck cystic lesion was aspirated to rule out a septic focus. Bone scan of the lower extremities ruled out infectious or malignant etiology. He was started on multiple antibiotics with a presumed diagnosis of sepsis. An ECHO on the 4<sup>th</sup> hospital day showed a pericardial effusion which required a pericardial window. He also developed bilateral pleural effusions which resolved with supportive treatment. Aspirates from the cystic lesions, pericardial fluid, blood and urine cultures were sterile. Even in the second week of hospital stay, he continued to spike high fevers (Tmax 107) with high white counts and left shift inspite of treatment with antibiotics. A diagnosis of systemic onset juvenile idiopathic arthritis (SOJIA) was made with input from rheumatologist. Antibiotics were discontinued and steroids were started with good response. Cystic lesions were treated with percutaneous sclerotherapy with doxycycline. He was discharged home on oral steroids, NSAID's and weekly methotrexate. Etanercept was added to decrease dependence on oral steroids. He remains in good health 2 years since initial presentation.

**Discussion:** A febrile toddler who refuses to walk is a common clinical presentation in pediatrics. Differential diagnosis of such a patient includes osteomyelitis, septic arthritis, acute rheumatic fever, leukemia and non-accidental trauma. The presence of systemic extra-articular symptoms as in our patient must alert the pediatrician to systemic onset juvenile rheumatoid arthritis (SOJIA). It accounts for 10-20% of all juvenile idiopathic arthritis (JIA) patients with an incidence of 0.4-0.8 per 100,000. SOJIA differs from other conditions in its multisystem involvement. Clinical features like pleurisy, pericarditis, spiking fevers, hepatosplenomegaly and lymphadenopathy overshadow the joint symptoms. The joint involvement may be completely absent or may be a late clinical feature. These patients have leukocytosis, thrombocytosis and high inflammatory markers simulating a septic focus. In our patient, the accurate diagnosis was complicated by the confounding presence of multiple cystic lymphatic lesions. Treatment of SOJIA is challenging. Oral steroids, NSAID's, methotrexate, etanercept and the newer anakinra have been used with varying success. Our case underlines the importance of considering a diagnosis of systemic onset JIA in a febrile toddler even in the absence of overt joint involvement.

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# Oral Presentation Abstracts

## Graduate Students

### MECHANISM OF INHIBITION OF *Escherichia coli* ATP SYNTHASE BY POLYPHENOLS AND THEIR DERIVATIVES

Prasanna K Dadi and Zulfiqar Ahmad, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

We have studied the inhibitory effect of natural and structurally modified polyphenols on *Escherichia coli* ATP synthase to test (I) if the beneficial dietary effects of polyphenols are related to their inhibitory actions on ATP synthase, (II) if inhibitory effects of polyphenolic compound could be augmented through structural modifications, and (III) if they can act as antimicrobial agent through their actions on ATP synthesis. X-ray crystal structures of bovine mitochondrial ATP synthase inhibited by resveratrol, piceatannol, and quercetin, suggested that these compounds bind in a distinct polyphenol binding pocket, a hydrophobic pocket, at the interface of a,b,-subunits. We found that the natural polyphenols such as resveratrol, piceatannol, quercetin, quercestrin, or quercetin-3-b-D glucoside all inhibit *Escherichia coli* ATP synthase to varying degrees. ATP synthase was fully inhibited by piceatannol with no residual activity; inhibition by other compounds was partial in the range of 40-80%. Piceatannol was the most potent inhibitor ( $IC_{50} \sim 14$  mM) followed by quercetin ( $IC_{50} \sim 33$  mM), quercetin-3-b-D glucoside ( $IC_{50} \sim 71$  mM), resveratrol ( $IC_{50} \sim 94$  mM), quercestrin ( $IC_{50} \sim 20$  mM). Inhibitory effect of structurally modified polyphenolic compounds also caused partial or complete inhibition. We found that the position of hydroxyl and nitro groups played critical role in the degree of binding and inhibition of ATPase activity. Also, introduction of nitro group on resveratrol augmented the inhibition on molar scale but addition of phosphate group did not. Presence of aromatic diol or triol ring structure with no free rotation resulted in poor inhibition of ATPase activity. Inhibition was identical in both  $F_1F_0$  membrane preparations as well as in isolated purified  $F_1$  and was reversible in all cases. Growth assays suggested that natural and modulated compounds used in this study inhibited  $F_1$ -ATPase and intact cell growth to varying degrees suggesting that dietary benefits of polyphenol may at least be in part due to the inhibition of ATP synthase and they can also act as antimicrobial agents through their actions on ATP synthase.

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### “I DIDN’T WANT TO TALK ABOUT IT”: BARRIERS TO FAMILY CANCER COMMUNICATION IN APPALACHIA

Kathryn Duvall<sup>1</sup>, Dr. Kelly Dorgan<sup>1</sup>, and Dr. Sadie Hutson<sup>2</sup>

<sup>1</sup>Department of Communication, College of Arts and Sciences

<sup>2</sup>College of Nursing

East Tennessee State University, Johnson City, TN

This study examined barriers to family cancer communication in Appalachia through the stories of Appalachian female cancer survivors. Well-documented disparities in the Appalachian region have been attributed to lack of access to health care professionals, lack of preventative care, being un- or under-insured, poverty, and lower levels of educational attainment. In light of these challenges, a cancer diagnosis in the Appalachian region may present unique challenges for survivors. Investigators collected the stories of 29 female Appalachian cancer survivors from Northeast Tennessee and Southwest Virginia via a mixed methods approach. The first phase consisted of survivors participating in a day-long story circle (n=26). For the story circle event, women were divided into two groups and asked to share their stories of cancer survivorship in Appalachia in two 4-hour sessions. In the second phase, additional survivors were identified to participate in in-depth interviews (n=3). The investigator used purposive sampling to select informants

based on the reasons cited for not attending the story circle event (ongoing cancer treatments, financial/transportation issues, and work conflicts.) The informants who participated in in-depth interviews were also asked to share their survivorship stories. The investigator conducted the interviews in the homes of participants. Interviews lasted between 60-120 minutes, and open-ended questions probed for what makes the cancer experience in Appalachia unique. Participation was voluntary and informed consent was obtained from each informant. Transcripts from the story circles and in-depth interviews were transcribed verbatim and uploaded into NVivo 8 to assist with coding and data organization. Qualitative content analysis was used to identify five barriers to family cancer communication: 1) the need to protect, 2) concern about psychological distress, 3) positive-only thinking, 4) the health of other family members, and 5) cancer in a “taboo” area. These findings suggest that Appalachian female cancer survivors struggle with similar issues as survivors outside of the region regarding family cancer communication. However, there appear to be additional barriers to family cancer communication for Appalachian women that may be a result of cultural norms of the region.

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### **SUBCELLULAR LOCALIZATION OF SALICYLIC ACID BINDING PROTEIN 2 (SABP2) IN *Nicotiana tabacum***

Leonard Yenwong Fai, Yutika Patel, Arianna Ingram and Dhirendra Kumar, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Many plants remain an inevitable source of food, medicine, fuel and other uses to mankind. Since these plants are continuously exposed to adverse conditions, their health and yield is greatly affected. Some plants have acquired defense mechanisms protecting themselves against adverse conditions. One of such defense mechanisms is the salicylic acid (SA) mediated defense response, which is the main defense mechanism triggered in some plants infected by microbial pathogens. Upon microbial infection, the level of salicylic acid in the infected plants increases about twenty folds. SA is made in the chloroplast and is converted to Methylsalicylate (MeSA) by Salicylic acid Methyl Transferase (SAMT), which then diffuses out of the chloroplast. SABP2 has been shown to catalyze the conversion of MeSA to SA. Increased levels of SA leads to a hypersensitive response resulting in death of the infected and immediately surrounding cells. This local resistance (LR) response sends signals to other uninfected cells throughout the plant which helps them to prepare for future attack (Systemic acquired resistance-SAR). SABP2 is a 29kDa, extremely low abundance tobacco protein, a member of the  $\alpha/\beta$  hydrolase superfamily of enzymes with methylesterase activity. Tobacco plants silenced in SABP2 expression, show suppressed local resistance to Tobacco Mosaic Virus, are unable to induce defense genes and develop SAR. SABP2 has been hypothesized to be localized in cytoplasm, but its precise localization is not known. Therefore, we used biochemical approaches to study localization of SABP2 in tobacco. Tobacco plants, 6-8 weeks old grown at 22°C, in an 16hour light cycle was treated with methyl jasmonate for 48 hours to induce SABP2 expression. Ammonium sulphate was used to precipitate cytoplasmic proteins, while intact chloroplasts were isolated using a discontinuous percoll gradient and further fractionated into stroma and membranes. Fractions from the cytoplasm, stoma, intact chloroplast and membranes were separated on a 12% SDS PAGE, and western analysis was done using polyclonal anti-SABP2 antibodies. Results show that SABP2 is associated to the chloroplast membranes. Similarly in chloroplast import assay experiments using purified SABP2 followed by western analysis of chloroplast fractionated samples shows that SAPB2 is imported to the chloroplast. This confirms that SABP2 is localized to the chloroplast and not cytoplasm as previously hypothesized. Exact localization of SABP2 inside the chloroplast (i.e. outer membrane, intermembrane space, inner membrane, stroma or thylakoid membrane) is being tested and results will be presented. SABP2 localization studies provides a better understanding of the metabolic pathway involved in SA-mediated defense response, and also the possibility of predicting SABP2 interactions which may be vital for its function. Studies on SA pathway may help to improve plants own natural immunity and could be used to reduce large scale use of pesticides in agriculture, which are environmentally unfriendly and cause health hazards.

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## **WILL GOOGLE WAVE IMPROVE COMMUNICATION IN PRODUCTION ENVIRONMENT?**

Will Haynes, Department of Engineering, Technology, Surveying and Digital Media, College of Business and Technology, East Tennessee State University, Johnson City, TN

The efficiency of currently applied methods of communication in the field of media production could be greatly increased with the use of new technology. This paper will investigate the communication lines in a production environment, specifically email. Ways to optimize these methods to streamline the communication between different areas and departments in a production environment will be explored specifically Google Wave. New technologies including media servers, faster connection lines, Internet applications and more powerful computers all open new options to improve communication speed and efficiency in production studios. Google Wave is a product that was opened into public beta in November 2009. Wave is described by Google as “equal parts conversation and document” using XML scripts to provide fast, seamless communication. Wave is also open source, so it can be customized for specific purposes. A major problem for studios is that information sent by email is receiver specific, and can only be shared as the receiver forwards updates and information. Google Wave allows for all users on the wave (the name for a message in Wave) to comment or add content to every part of the message they receive. Google Wave also addresses the studios’ problem of “turn around” time. Google Wave is a live collaboration tool. Users can see edits or imbedded videos immediately. As one user changes the wave, the others can watch and suggest changes in real time. Google Wave has the potential to answer many of the communication problems the media production industry currently faces. It is a faster, more comprehensive form of Internet mail. Is Google wave enough to answer the needs of industry? Or is it just the first step in the right direction?

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## **ROLE OF VISIT-DG SEQUENCE RESIDUE $\alpha$ ASP-350 IN THE CATALYTIC SITES OF *ESCHERICHIA COLI* ATP SYNTHASE**

Sneha Jonnalagadda and Zulfiqar Ahmad, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

ATP Synthase is the fundamental means of cellular energy production in animals, plants and almost in all microorganisms. Structurally this enzyme is highly conserved so is the  $\alpha$ VISIT-DG sequence at the interface of  $\alpha/\beta$  subunits which contains residues from 345-351. These residues are right on the top of phosphate subdomain residues in the catalytic site contribute mainly by  $\beta$ -subunit residues. Question arises what are they doing there? Are they involved directly or indirectly in phosphate binding or are they providing structural maintenance of the catalytic site? Do they have any functional importance? To answer these questions our lab is looking into the functional roles played by the VISIT-DG sequence residues.  $\alpha$ Asp -350 is unique for not only having a negatively charged side chain but is within 3 Å from the positively charged known phosphate binding residue  $\alpha$ Arg-376. Here we will discuss some of interesting findings on the role of  $\alpha$ Asp-350 residue.

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**A PREDICTIVE MODEL FOR SECONDARY RNA STRUCTURES:  
A GRAPH THEORETIC APPROACH  
FOR CATALOGING SECONDARY RNA STRUCTURES**

Denise Koessler, Teresa Haynes and Debra Knisley, Department of Mathematics, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Understanding the formation of RNA structures from base pairings is an open problem in biological research. We apply graph theory to study this problem. Through a project supported by the National Science Foundation, the New York University RNA team provides an online database of trees representing possible secondary RNA structures. Considering these graphical models, we ascertain the frequency of occurrence of a tree by determining all possible ways two smaller trees could bond together to form it. In graph theory, two vertices are said to be identified if they are combined into a single vertex whose neighborhood is their neighborhood union. We use this process to model the bonding of base pairs of RNA tree structures to form a single tree. Given each tree's bonding information, we will use a neural network to predict the likelihood of a tree existing in nature as an RNA structure.

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**XPA-MEDIATED REGULATION OF NUCLEOTIDE EXCISION REPAIR  
OF UV-DNA DAMAGE IS P53- SIGNALING DEPENDENT  
AND OCCURS EXCLUSIVELY IN S-PHASE**

Zhengke Li, Zhiping Dong, Moises Serrano, Hui Tang, Benjamin Hilton, Philip R Musich, and Yue Zou, Department of Biochemistry and Molecular Biology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

Human genome is under constant threats of damage from various environmental genotoxic pollutants and carcinogens. In cells removal of DNA damage requires dual actions and coordination of cell cycle checkpoints and DNA repair machineries. It is believed that the checkpoint pathways play an important role in regulation of DNA repair pathways. However, how the regulation occurs throughout the cell cycle remains largely unknown. In the current study, we demonstrated that ATR-dependent checkpoint regulates nucleotide excision repair (NER) via p53 in a cell cycle dependent manner. We found that in the G0/G1 phase of synchronizing cells, majority of XPA remained in the cytoplasm even when cells were treated with DNA damage agent. By contrast, while most of XPA in S-phase were located in the cytoplasm in the absence of DNA damage, they were imported into nucleus upon UV irradiation. Interestingly, in G2 phase most of XPA were found in the nucleus either with or without DNA damage. We further demonstrated that siRNA knockdown of cell cycle checkpoint protein p53 abrogated the UV-induced nuclear translocation of XPA, while silence of checkpoint kinase 1 (Chk1) or MAPKAP Kinase-2 (MK2) had no effect on the translocation. Inhibition of p53 transcriptional activities by inhibitor also abolished XPA nuclear import. Surprisingly, however, these effects of p53 did not hold in the p53 deficient human lung cancer cells (H1299). And the nuclear import of XPA upon DNA damage was not regulated by any of the known checkpoint proteins such as ATR, Ataxia-Telangiectasia mutated (ATM), Chk1/Chk2 or p38/MK2. We conclude that in response to UV-induced DNA damage, NER is regulated via XPA nuclear import by ATR/p53 checkpoint signaling pathway which occurred exclusively in S-phase. In the case of p53 deficient cancer cells, an unknown alternative pathway could be possibly responsible for the regulation of XPA nuclear translocation after DNA damage. Further investigation is needed to identify the pathways in the future.

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**IDENTIFICATION, RECOMBINANT EXPRESSION AND CHARACTERIZATION OF  
PUTATIVE SECONDARY PRODUCT GLUCOSYLTRANSFERASE CLONES FROM *CITRUS  
PARADISI***

Zhangfan Lin<sup>1</sup>, Daniel K. Owens<sup>1</sup>, Cecilia A. McIntosh<sup>1,2</sup>.

<sup>1</sup>Department of Biological Sciences, College of Arts and Sciences

<sup>2</sup>School of Graduate Studies,

East Tennessee State University, Johnson City, TN

Flavonoids are a class of plant secondary metabolites that fulfill many functions including UV protection, pigmentation, antipathogenic properties and feeding deterrents. Glucosylation helps flavonoids perform their *in planta* roles, e.g. easier transportation and storage of flavonoids in the cell. These reactions are catalyzed by glucosyltransferases (GTs). The McIntosh lab research focuses on flavonoid metabolism and structure/function analysis of secondary product GTs. *Citrus paradisi* (grapefruit) is used as the model plant system since it is very active in flavonoid metabolism and possesses a variety of secondary product GTs. Part of the project is designed to test the hypothesis that putative GT 10 (PGT10) is a flavonoid glucosyltransferase. PGT10 was cloned into the pCD1 vector which contains thioredoxin and 6X His tags as well as a thrombin proteolytic cleavage site to remove these tags after recombinant expression. The protein was heterologously expressed and purified from *E.coli* extracts by immobilized metal ion affinity chromatography; however the majority of the expressed protein was found in insoluble inclusion bodies. In order to increase the amount of active soluble protein, an agrobacterium-mediated transient expression system and optimization of the *E.coli* growth conditions with/without addition of the osmolytes betaine/sorbitol were attempted. However, both of these methods failed to increase the solubility of PGT10. Optimized culture conditions for expression of soluble PGT10 were found to be 10C and 18 hours. Screening assays were done by using 32 different flavonoid substrates and have not yet revealed the substrate for the PGT10 protein. Effects to identify the reaction catalyzed by PGT10 continue. A second part of the project is designed to test the hypothesis that the multiple bands of PGT 5/6 found in root cDNA by RT-PCR contain a set of homologous genes. According to the previously identified gene pieces, new primers were designed and used in RACE PCR by using young leaves RNA extractions. So far, the 5' end's products have been successfully cloned and sequenced.

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**IDENTIFICATION AND EVALUATION OF ESTERASE PRODRUG TARGETS IN PROSTATE  
CANCER**

Christopher A. McGoldrick<sup>1</sup>, Marianne F. Brannon<sup>1</sup>, Yu-Lin Jiang<sup>2</sup>, Victor Paromov<sup>1</sup>, and William L. Stone<sup>1</sup>,

<sup>1</sup>Department of Pediatrics, Quillen College of Medicine, <sup>2</sup>Department of Chemistry, College of Arts and

Sciences, East Tennessee State University, Johnson City, TN

Approximately one in six men will be diagnosed with prostate cancer making prostate cancer the most frequently diagnosed cancer and the leading cause of cancer related death in American men. Prostate cancer typically has a long latency period with little growth and few symptoms, making chemopreventive agents such as chiral prodrugs an attractive approach to treating prostate cancer. A prodrug is an inactive precursor of a drug that is converted into an active form by a target enzyme within the cell. The ideal target enzyme would be highly expressed in cancer cells, but expressed at low levels in normal cells. In addition, the ideal target enzyme in cancer cells would have the opposite chiral substrate specificity compared with normal cells. Nontumorigenic human prostate (RWPE-1) and human prostate cancer (LNCaP) cell cultures were used to identify prostate cancer-specific esterases with the potential to catalyze prodrug activation. RWPE-1 and LNCaP cell cultures were lysed and subjected to native polyacrylimide gel electrophoresis. Esterase-active bands were then visualized by incubating the gel with Fast Blue RR salt and the chiral specific substrates (R)-alpha-naphthyl N-acetylalaninate (R-ANAA) or (S)-alpha-naphthyl N-acetylalaninate (S-ANAA). There was a marked increase in esterase-active bands displayed in LNCaP cells compared with RWPE-1 cells. Both cell lines showed a catalytic preference for the S-ANAA isomer. Each of the resulting esterase-active bands was further evaluated by nanospray reverse phase tandem mass spectrometry (LC-MS/MS). LC-MS/MS analysis identified acylamino-acid-releasing enzyme (AARE), caspase-12 (CASP12)

and several other proteins. Native Western blot analysis confirmed AARE and CASP12 as major proteins present within the esterase-active bands. Subsequent immunoprecipitation and protease inhibition experiments revealed AARE and CASP12 as the enzymes responsible for the observed hydrolytic activity. The potential anticancer effects of four chiral NO-donating prodrug analogues modeled after R- and S-ANAA were studied in LNCaP and RWPE-1 cells using MTS viability assays, caspase-3 assays, and glutathione depletions assays. Upon hydrolysis, these NO-donating analogues produce a quinone methide product that has been shown to react with and deplete cellular glutathione (GSH) inducing apoptosis. There was significant growth inhibition in cancer cells treated with two of the four prodrugs. Cell cultures and lysates treated with either of these two prodrugs showed significant GSH depletion, as well as increased caspase-3 activity suggesting that the prodrugs induced apoptosis. In conclusion, we have identified AARE and CASP12 as hydrolytic enzymes with strong potential as chiral ester prodrug targets. While we were not able to distinguish a difference in chiral preference in the esterases between RWPE-1 and LNCaP cell lines, the relative abundance of these esterases between RWPE-1 and LNCaP was exploited to produce anti-cancer effects with minimal impact on nontumorigenic RWPE-1 cells. This study will aid in future prodrug synthesis, and the identification and evaluation of potential prodrug targets to treat prostate cancer.

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### **TOTAL DOMINATION DOT-CRITICAL AND DOT-STABLE GRAPHS**

Stephanie A. McMahon and Teresa W. Haynes, Department of Mathematics, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Two vertices are said to be identified if they are combined to form one vertex whose neighborhood is their neighborhood union. A graph is total domination dot-critical if identifying any pair of adjacent vertices decreases the total domination number. On the other hand, a graph is total domination dot-stable if identifying any pair of adjacent vertices leaves the total domination number unchanged. Identifying any pair of vertices cannot increase the total domination number, and we show it can decrease the total domination number by at most two. Among other results, we characterize total domination dot-critical trees with total domination number three and all total domination dot-stable graphs.

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### **EFFECTS OF FILM ON NATION BRANDING: THAILAND, A CASE STUDY**

Anthony Chase Mitchell, Department of Communications, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

This paper researches American filmmakers' depictions of Thailand and subsequent effects on the country's image in an international context namely its *national brand*. Pulling from cultivation and framing theory, popular narrative films influence on the world's perception of a nation, in this case Thailand, is discussed. The research begins with a review of literature detailing the historical contexts within which Thailand has existed in a Western worldview, particularly common beliefs held by Americans and Brits. After establishing past trends, research surrounding current Western perceptions of Thailand revolves around new media, specifically its image as portrayed on YouTube, Facebook, and Google. With before and after shots detailing Western views of Thailand, an analysis of American filmic depictions of the country explores films' influence on the branding of nations. Three points summarize the process of inquiry: (1) the identification of historical Western worldviews in regard to Thailand, (2) the identification of current Western perceptions of Thailand via new media, and (3) the discussion of modern American films' influence on how the West views a foreign nation. Cultivation and framing theory provide the framework for this discussion. In lieu of the findings, a shift is presented, one characterized by Western apathy and ignorance towards ethnocentrism founded in half-truths and false constructions of reality. Thailand's reputation is also discussed, namely its tendency to bring to mind prostitution, human trafficking, and

political corruption and instability. The findings shed light on the power of cultivation and framing theories in this context how the West's historical ignorance concerning Thailand, its people, and its culture, has been absorbed into its falsely educated ethnocentric worldview, largely due to American film and its portrayal of Thailand.

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### **“INTERNET GAP”: WOMEN JOINING SOCIAL NETWORKING SITES**

Carol B. Patton, Department of Engineering, Technology, Surveying and Digital Media, College of Business and Technology, East Tennessee State University, Johnson City, TN

The purpose of this paper is to investigate why more women, especially those over the age of 35, are joining social networking sites. According to a recent report on the demographics of Facebook from istrategylabs, females make up over 55% of Facebook users, with 29% of all users falling in the 35-54 age groups. The number of users is drastically reduced to only 9.5% over the age of 55. Lack of knowledge, education, and limited finances are why some Baby Boomers and even seniors demonstrate a reluctance to use the computer keeping them from exploring the advantages of the computer. After conducting a recent survey “*Social Networking Sites and the Women Who Use them*”, the results from similar studies and interviews, do indicate a growth in the number of women joining social networking sites, of which a large majority favored Facebook. Staying in touch with family plays a large part in motivating women to become members of social networking sites. Information from studies, surveys, focus groups, etc., is fundamental for sites like Facebook who are continually looking for ways to attract new members while maintaining the needs of current members.

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### **DIFFERENTIALS AND ZERO SETS IN GRAPHS**

Hamilton Scott<sup>1</sup>, Teresa Haynes<sup>1</sup>, and Stephen Hedetniemi<sup>2</sup>

<sup>1</sup>Department of Mathematics, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

<sup>2</sup>School of Computing, Clemson University, Clemson, SC

In mathematics and computer science, graph theory is the study of graphs: abstract models used to represent a set of objects in which some pairs of objects are adjacent. The objects are called vertices and the adjacencies are called edges. We consider the following situation. You are allowed to buy as many tokens as you like at a cost of \$1 each. You place the tokens on a subset S of vertices. For each vertex of the graph which has no token on it, but is adjacent to a vertex with a token on it, you receive \$1. A set S is called a zero set if its profit is zero. Using mathematical reasoning we study the theory of zero sets. We give proofs of the existence of zero sets in various kinds of graphs such as even order graphs, bipartite graphs, and graphs of maximum degree 3. We also give proofs regarding the existence of graphs which contain no zero sets and the construction of zero-free graphs from graphs which contain zero sets. Applications include economic and tournament related situations.

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## **REQUIREMENT OF DELSEED-MOTIF OF *ESCHERICHIA COLI* ATP SYNTHASE IN PEPTIDE BINDING**

Junior Tayou and Zulfiqar Ahmad, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University

F<sub>1</sub>F<sub>0</sub> ATP synthase enzyme is a ubiquitously distributed membrane bound enzyme capable of coupling reversibly the hydrolysis and synthesis of ATP. This enzyme is found on the inner membrane of the mitochondria, chloroplasts, plasma membrane of bacteria, and on the plasma membrane of mammalian cells such as adipocytes, keratinocytes and endothelial cells. Lately a-helical cationic amphiphilic peptides such as melittin from honey bee venom and melittin related peptide from frog skin have shown been shown to inhibit the *E. coli* ATP synthase. The proposed but unconfirmed site based on indirect evidence is bDELSEED-motif formed by the residues 380-386 at the interface of a/b subunit of ATP synthase. We have embarked on the mutagenic analysis of bDELSEED –motif residues in order to understand the binding mechanism and mode of action of peptides. Mechanistic knowledge of peptide binding will be helpful understanding the antibacterial/anticancer nature of the above peptides. The main questions we have are: 1) if the antibacterial/anticancer effects of these peptides are related to their inhibitory action on ATP synthase? and 2) if so which residues play critical role in the binding of peptides?

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## **FUNCTIONAL ANALYSIS OF DISEASE RESISTANCE INDUCED BY ACIBENZOLAR-S-METHYL IN PLANTS**

Diwaker Tripathi and Dhirendra Kumar, Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

Plants continuously face adverse conditions in the field that range from various stress conditions to pathogen attacks. High disease incidences caused by pathogens ultimately reduce the productivity of food and non-food crop plants. One of the most efficient strategies to combat pathogen attacks involves the enhancement of plant's own natural defense system using chemical activators. At molecular level, the earliest defense response by a plant against pathogens is triggered by the recognition and interaction between pathogen's elicitor [avirulence (Avr)] molecules and plant's resistance (R) proteins. This defense response includes a series of chemical reactions that ends up with the accumulation of defense proteins at the site of infection. The signal from this localized infection site travels to other uninfected parts of the plant and induces resistance in the uninfected systemic tissues. This systemic resistance is known as systemic acquired resistance (SAR), and it provides protection against subsequent attacks from a broad range of pathogens. SAR requires the accumulation of phenolic salicylic acid, and it has been shown to develop with the increased expression of a large number of pathogenesis-related (*PR*) gene families in both local and systemic tissues. Recently it has been shown that a 29 kDa plant protein, salicylic acid binding protein 2 (SABP2) is critical for the successful development of SAR as it converts inactive methyl salicylic acid into salicylic acid. Besides pathogens, SAR could also be induced by pretreatment with salicylic acid (SA) and its functional analogs e.g. INA, ASM (BTH) etc. Benzo (1, 2, 3) thiadiazole -7- carbothionic acid S-methyl ester (BTH also known as ASM (Acibenzolar-S-Methyl) has been shown as the most potent activator of SAR. Studies have confirmed that the functioning of ASM is independent of SA accumulation, however the exact action mechanism of this chemical is still not clearly defined. We therefore investigated the molecular mechanism of ASM mediated SAR signaling pathway in plants. TLC and HPLC analyses were performed to test if SABP2 could catalyze the conversion of ASM (ester) into acibenzolar (acid). To determine the role of SABP2 in ASM induced SAR in plants; transgenic tobacco plants silenced in SABP2 expression were used. The expression of defense protein, PR1 was used as a marker to test the induction of SAR. The level of ASM induced SAR response was assessed by measuring the TMV induced lesion sizes on the systemic leaves of ASM treated SABP2- silenced and control plants. Our results show that SABP2 converts ASM into acibenzolar, which induces the expression of PR1 proteins and develops the SAR in ASM treated plants. This study will help to develop better chemical activators of SAR, which may utilize SABP2 for their conversion into the active forms. Availability of better chemical activators of plant defense will reduce our dependence on harmful pesticides.

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## **ONE STORY, A MILLION AUTHORS**

Matthew Via, Department of Engineering, Technology, Surveying and Digital Media, College of Business and Technology, East Tennessee State University, Johnson City, TN

When video games first entered the world, they were created by engineers and were focused on the technology used to create them. Over time, as the technology became more accessible, artists and designers took over game design, but still these games had little or no focus on the story being conveyed. In the last several years, professional writers have begun to enter the industry making the video game a storytelling medium like no other. Video games present the opportunity to truly involve the observer through their interactive nature. Advances in technology have made it possible to produce interactive stories that allow the player to explore the world around them, interact with the people of that world, and personally influence the events of the story.

This research examines how interactive storytelling through video games has developed over the years and what impact it is having on how stories are told. Several examples of games that focus on interactive storytelling are studied to understand the techniques used to further involve the player in the story. The research analyzes techniques for writing interactive stories, the limitations that are associated with this medium, and how those limitations are being overcome. It will explore the impact this storytelling method may have on player immersion and what advantages it may have for both the gaming industry and storytelling as a whole.

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## **SELF-HARM AND SUICIDE BEHAVIORS IN COLLEGE STUDENTS: THE MODERATING ROLE OF SOCIAL PROBLEM SOLVING ABILITY.**

Kristin Walker<sup>1</sup>, C. Rowe<sup>1</sup>, L. Tindell<sup>1</sup>, E.L. Jeglic<sup>2</sup>, and Jameson K. Hirsch<sup>1</sup>,

<sup>1</sup>Department of Psychology, College of Arts and Sciences, East Tennessee State University, Johnson City, TN, and <sup>2</sup>John Jay College of Criminal Justice, SUNY.

Suicide is a significant public health problem and the 2nd leading cause of death among college students (Heron et al., 2009; US PHS, 1999). Suicide is also the 3rd leading cause of death during late adolescence and early adulthood (NCHS, 2004). Individuals who engage in deliberate self-injurious behaviors are at increased risk for future suicidal thoughts and behaviors (Hawton et al., 2003; Cooper et al., 2005). We investigated the relationship between self harm and suicide outcomes, including suicide ideation and attempts, and examined the potential moderating role of social problem-solving ability. We hypothesized that greater levels of self-injurious behaviors would be associated with greater levels of suicide outcomes, and that social problem-solving ability would moderate this relationship. Our ethnically diverse sample (41.5% Hispanic, 25.4% African American, 18.4% Caucasian) of 384 participants (70% Female; Mean Age = 19.60, SD = 3.12) were recruited from a large Northeastern university. Participants completed the self-report Self-Harm Inventory (SHI), Suicidal Behaviors Questionnaire (SBQ), and Social Problem Solving Inventory-Revised (SPSI-R). At the bivariate level, for all participants, self-harming behaviors were significantly positively associated with suicide outcomes ( $r=.56$ ;  $p<.01$ ). Social problem solving was significantly negatively associated with self harm ( $r=-.23$ ;  $p<.01$ ) and suicide outcomes ( $r=-.36$ ;  $p<.01$ ). Using a multivariate, hierarchical linear regression, we found that greater levels of self-injurious behaviors significantly predicted greater total score on the SBQ, and social problem-solving ability moderated this relationship,  $t = -3.07$ ,  $p<.01$ , Un.  $\beta = -.05$  [SE = .02], for the entire sample. When the sample was stratified by ethnicity, social problem solving continued to moderate the association between self-harm and suicide outcomes for African Americans,  $t = -4.19$ ,  $p<.01$ , Un.  $\beta = -.07$  [SE = .02], Hispanics,  $t = -7.43$ ,  $p<.01$ , Un.  $\beta = -.06$  [SE = .01], Caucasians,  $t = -7.90$ ,  $p<.01$ , Un.  $\beta = -.08$  [SE = .01], and Asian Americans,  $t = -5.13$ ,  $p<.01$ , Un.  $\beta = -.09$  [SE = .02]. Social problem solving ability, frequently conceptualized using factors such as problem definition, generating alternative responses, and decision making, (D'Zurilla et al., 2002) is often reduced in individuals who engage in self-harm and endorse suicide behaviors (McLaughlin et al., 1996; Pollock and Williams, 2004). Our findings extend the research on problem solving and self harm, which generally indicate that high levels of problem solving can reduce suicidal ideation (Pollock

and Williams, 2004); problem-solving may also be a buffer in the transition from self-injury to suicide. Importantly, our results demonstrate that problem solving ability impacts the relationship between self-harm and suicide outcomes somewhat universally across ethnic groups. Brief interventions designed to increase problem solving ability may increase an individual's sense of competence and autonomy (Evans, 2000), perhaps reducing the likelihood of progression from self-harming, non-suicidal behaviors to more lethal thoughts of suicide and suicide attempts.

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### **EFFECTS OF MATERNAL DEPRESSION ON THE DEVELOPMENT OF CHILDHOOD OBESITY**

Liang Wang, MD, MPH, and Tiejian Wu, MD, MS, PhD, College of Public Health, East Tennessee State University, Johnson City, TN

**Objectives:** 1) To describe the prevalence of maternal depression & obesity and overweight over childhood, and 2) To examine the longitudinal association of maternal depression status with body mass measurements and the development of overweight and obesity. **Methods:** The longitudinal association of maternal depression status with body mass measurements and the development of childhood obesity were examined using the data set from the NICHD Study of Early Child Care and Youth Development. Maternal Depression was assessed by use of the Center of Epidemiological Studies Depression Scale (CES-D) and defined as a score of 16 or greater. Childhood obesity status was defined according to the CDC's criteria. Maternal depression was assessed when child was at the first month, 36 months, and Grade 1. Obesity status was assessed at 36 months, Grade 1, Grade 3, and Grade 6. The effect of change/persistence in maternal depression over childhood on the development of childhood obesity was analyzed. **Results:** The prevalence of maternal depression at first month, 36 months, and Grade 1 was 25.6%, 15.0%, and 12.5% respectively. The prevalence of overweight or obesity at 36 months, Grade 1, Grade 3, and Grade 6 was 14.9%, 18.4%, 21.5%, and 22.9%, respectively. Children with mothers depressed at first month after birth had a higher risk of childhood overweight or obesity at 36 months and Grade 1 than children with mothers not depressed at first month. Maternal depression at Grade 1 was associated with a higher risk of development of childhood overweight and obesity at Grade 6. Children were at highest risk to be overweight and obese at Grade 3 and Grade 6 if mothers had persistent depression. After adjusting several confounders, the development of childhood overweight and obesity was at a higher risk if mothers had depression at more time points. **Conclusion:** Maternal depression was associated with the development of childhood obesity. Child obesity intervention efforts may benefit from strategies including improving maternal mental health status.

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### **BODY LANGUAGE, THE VISUAL COMMUNICATION IN THREE-DIMENSIONAL POSE-TO-POSE CG CHARACTER ANIMATIONS**

Liang Wang, Department of Engineering, Technology, Surveying and Digital Media, College of Business and Technology, East Tennessee State University, Johnson City, TN

Body language has a significant importance in our daily lives for interaction and communication. It is a universal element of visual communication that transcends cultural background or spoken language. Animators apply body language as a method to express the emotions of CG characters and enhance their characteristics. In pose-to-pose animations, each pose, as a "key pose" or a "key frame," contains both the emotional elements and the enhanced non-verbal communication of a certain pose or gesture. The animation process connects all these "key poses" seamlessly and smoothly in terms of time and movement. However, different body movements and timing result different communicational meanings to the audience, which may or may not be the initial intent of the animators. This paper examines body language in CG character animation, by focusing on how American audiences, as a cultural group, identifying CG characters' characteristics and their emotions on a personality level. This paper will explore

in three areas: the definition and principles of pose-to-pose character animation, the properties and features of the body language used for character animations, and how this animated “language” communicates to the American audiences culturally and non-verbally. The research result will help pose-to-pose character animators and students have a better understanding of how to create lively CG characters for American audiences by using appropriate body language, to communicate more efficiently and precisely.

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### HIDDEN SYMBOLISM IN MODERN LOGO DESIGN

Chris Zidek, Department of Engineering, Technology, Surveying and Digital Media, College of Business and Technology, East Tennessee State University, Johnson City, TN

This research will examine the use of sacred geometric principles within international corporation logo design. Sacred Geometry is a worldview of pattern recognition, and the symbol or logo is obtained by recombining simple shapes in a manner that results in meaningful or spiritual form. Even the simplest looking sacred geometry has a complex underlying structure that is unseen once the final design is obtained. The practice of sacred geometry is over 10,000 years old and can be found in churches, mosques, Buddhist sand art, modern architecture, logo design, and ancient megaliths, such as stone henge and the pyramids at Giza. Sacred geometry is also naturally occurring in hurricanes, spiral galaxies, sunflowers, the human skeletal system, high acceleration particle collisions, molecules, the human inner ear, fish, and many other organic life forms. Research has shown the human body to be formed in a sacred geometric proportion, the golden ratio. When humans see these forms it has a resonance that is of a subconscious origin. In this paper, examples of logos including National Geographic's rectangle, Targets concentric circles, and NBC's eye logo will be deconstructed and analyzed according to the practice of sacred geometry. National Geographic's rectangle logo is constructed via phi, or also known as the golden mean. This ratio known as the golden mean is proportion as to how the bones in the human hand form. Targets concentric circle logo has an Earth to moon proportion, and NBC's eye logo is based on a two fold geometry often represented as the "Jesus fish". The intentional use of sacred geometric principles in modern logo design and visual communication isn't surprising. These patterns and combinations of shapes are ancient and spiritual in nature, so what are the implications of these corporations having a working knowledge of sacred geometry?

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## Medical Residents and Post-Doctoral Fellows

### SAPHENOUS VENOUS GRAFT PSEUDOANEURYSM, AN EXTREMELY RARE CAUSE OF CHEST PAIN AND SYNCOPES

Lucien N. Abboud, M.D.<sup>1</sup>, Costy Mattar, M.D.<sup>2</sup>,

<sup>1</sup>Quillen College of Medicine, East Tennessee State University, Johnson City, TN.

<sup>2</sup>Cardiology Department, Mountain Home Veterans Affairs Hospital, Johnson City, TN

Saphenous vein graft pseudoaneurysms (SVG) are an extremely rare (<1%) but potentially life threatening complication of coronary artery bypass grafting (CABG) with an in-hospital mortality of 15.7%. Even SVG pseudoaneurysms are typically 6 times less frequent than aneurysms. We describe a case of a large SVG pseudoaneurysm (6.1 X 8.5 cm) found accidentally on a computed tomography scan of the chest in a patient who presented with syncope and atypical chest pain. The mass was located posterior to the left atrium. The differential diagnosis was a benign pericardial cyst or possible mediastinal malignancy. Despite symptom overlap with other diseases, SVG aneurysm or pseudoaneurysm should be considered in

patients with remote history (> 10 years) of coronary artery bypass graft surgery, presenting with acute coronary syndrome, new onset heart failure or syncope. Until now, surgery is still considered the treatment of choice. Prevention of wall injury and preserving the integrity of the vein endothelial surface may be the optimal way to minimize the incidence of such dangerous CABG related complication.

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### A RARE CAUSE OF FUO: PRIMARY SCLEROSING CHOLANGITIS

Umbar Ghaffar, MD<sup>1</sup>, and R.D.Smalligan, MD, MPH<sup>2</sup>,

<sup>1</sup>Quillen College of Medicine, East Tennessee State University, Johnson City, TN,

<sup>2</sup>Texas Tech University Health Sciences Center, Amarillo, Texas.

Fever of unknown origin (FUO) in a patient is always a challenge to diagnose, with occult infection being the most common and a long list of more rare entities following. We present a rare case of primary sclerosing cholangitis (PSC) causing FUO. **CASE:** A 54yo white man with a h/o hepatitis C and Crohn's disease both in remission presented with a month of daily fever and chills, lower abdominal pain, fatigue and a 20 pound weight loss. He denied diarrhea, nausea, vomiting and hematochezia. No recent travel, sick contacts or tick bites. One week of levofloxacin had no effect early in the course. PMH: S. *intermedius* liver abscess in 2000, sigmoid colectomy. Meds: aspirin, mesalamine , prednisone. PE: T 99.4, no jaundice, rash or lymphadenopathy, lungs, chest and abdominal exams normal. CXR: normal. Labs: Hgb: 10.8, WBC: 23.0 with 86%PMNs, Tbili 2.4, AlkPhos 321, ALT: 49, AST: 29, UA negative. Hospital Course: Extensive search for cause of fever included pancultures (neg), HIV (neg) ESR 100, ANA/RF anti-histone, anti-smooth muscle, anti-mitochondrial ab, UPEP, SPEP all negative. CT and MRI of the abdomen were inconclusive but suggestive of biliary disease but ERCP confirmed PSC (after brushings and further labs returned neg for cancer). Treatment with ursodeoxycholic acid (UDCA) resulted in resolution of symptoms and fever. FUO is a significant diagnostic challenge by definition (3 weeks of unexplained fever or 1 week of hospital diagnostic search without success). While most patients will ultimately be diagnosed with an infection (40%), cancer (30%), or a collagen vascular disease (20%), a small percentage will have a more rare cause or go undiagnosed. Our case demonstrates a very rare cause of FUO: primary sclerosing cholangitis. PSC is a rare (1 per 100,000) progressive disease of unknown etiology that causes inflammation, fibrosis and strictures of the intra and extra-hepatic biliary tree. It has been associated highly with many diseases, most commonly ulcerative colitis but also with , Celiac disease, sarcoidosis, chronic pancreatitis, RA, thyroiditis, Sjogrens, autoimmune hepatitis, systemic sclerosis, SLE and ITP. Choledocholithiasis, trauma, ischemia, chemical toxicity, infection, AIDS and malignancy have also been implicated as causative agents. The average age at diagnosis is 40 and patients range from asymptomatic with abnormal LFTs to fatigue, pruritis, fevers, night sweats, RUQ pain, and jaundice. Typical lab findings include elevated alkaline phosphatase, AST/ALT (<300 usually), direct bilirubin, and may have a positive P-ANCA (30-80%), ANA, RF and anti-smooth muscle ab though anti-mitochondrial ab is usually negative. ERCP is the gold standard for clinching the diagnosis but cancer must be excluded in the process. Untreated PSC may lead to liver failure, portal hypertension, hepatic osteodystrophy , steatorrhea or fat soluble vitamin deficiency. Treatment has been attempted with UDCA, prednisone, azathioprine and colchicines with varying degrees of success. Cholangioloplasty of critical biliary strictures or balloon dilatation can alleviate pruritis and diminish cholangitic episodes. Biliary tract reconstructive procedures are considered palliative. Liver transplantation has been shown to prolong survival in patients with advanced liver disease due to their PSC.

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### WHEN A CELLULITIS ISN'T JUST A CELLULITIS: A CASE OF LYME DISEASE DIAGNOSED IN EAST TENNESSEE

Jennifer Gibson, MD, and Demetrio Macariola, MD, Department of Pediatrics,  
Quillen College of Medicine, East Tennessee State University, Johnson City, TN

The etiology of an infectious skin lesion is not always easy for a physician to determine; and obtaining cultures of the affected area may be difficult or impossible. In almost all cases, treatment with broad-spectrum antibiotics is started prior to knowledge of a definitive microbial cause. However, diagnosis and

treatment of any infection should be guided by the patient's history whenever possible. In one case, a 9-year-old male from Maryland presented with a 3-4 week history of fever and an expanding erythematous skin lesion on his abdomen which had not responded to two courses of oral antibiotics. A diagnosis of cellulitis was made; however, due to the patient's history of living in Maryland, a diagnosis of Lyme Disease was also considered. The patient was hospitalized and treated with intravenous Vancomycin and Rocephin for two days with response to treatment noted. He was discharged from the hospital with prescriptions for a 14-day course of oral clindamycin and amoxicillin; and at discharge, titers for antibodies against *Borrelia burgdorferi*, the bacterial cause of Lyme Disease, were drawn. Several days after the patient's discharge, these titers enabled a definitive diagnosis of Lyme Disease to be made. Knowledge of the most common bacterial causes of cellulitis as well as the bacterial cause of Lyme Disease allowed for both possible diagnoses to be covered with a simple oral antibiotic regimen.

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#### **MEMBRANE-ASSOCIATED ESTROGEN RECEPTORS CONTRIBUTE TO THE SUCCESS OF *CHLAMYDIA TRACHOMATIS* INFECTIONS IN THE HUMAN ENDOMETRIAL ISHIKAWA CELL LINE.**

Jennifer Vanover Hall, Maria Schell, Cheryl Moore, Judy Whittimore and Priscilla B. Wyrick, Department of Microbiology, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

*C. trachomatis* remains one of the most prevalent sexually transmitted disease agents worldwide. It is the leading bacterial sexually transmitted agent in the United States with 4 million cases each year. Infections with this organism can be mild or even asymptomatic. However, if left untreated, chlamydial infections can cause serious disease complications, especially in women, including pelvic inflammatory disease, ectopic pregnancy and tubal infertility. Previous work suggests that the female hormone, estrogen, has an effect on chlamydial infection. In guinea pigs, dissemination of *C. trachomatis* and oviduct pathology were more extensive in the estrogen-dominant phase. Likewise, infection of explanted, primary human endometrial epithelial cells was greater when samples were collected during the estrous phase as opposed to collections made during progesterone-dominant phase. One possible explanation for these observations is a physiological role in which the epithelial response to estrogen provides an environment that is conducive to chlamydial growth. For instance, estrogen has proliferative effects on epithelia; thus, during estrous phase, numerous susceptible host cells are present and available to chlamydial infection. Chlamydial elementary bodies (EB) have been associated with the estrogen receptor-specific chaperone protein, protein disulfide isomerase (PDI), on the surface of endometrial epithelial cells. Studies have demonstrated that when PDI is blocked with antibodies, chlamydial infection is adversely affected. Therefore, it is possible that membrane-associated estrogen receptors (mER) or proteins involved in the estrogen receptor complex on the eukaryotic plasma membrane could serve as receptors for chlamydial entry. A third option for the role of estrogen in chlamydial infection is that estrogen receptors, themselves, are important to chlamydial entry and the physiological response of the host to this hormone is vital to the developmental cycle of *C. trachomatis*. In the current study, we have examined chlamydial infections in the hormone-responsive endometrial cell line, Ishikawa, in the presence or absence of estrogen or functional estrogen receptors. Antibody blockage of PDI, estrogen receptor  $\alpha$  (ER $\alpha$ ), ER $\beta$  and progesterone receptor (PGR) alone or antibody blockage of all three hormone receptors consecutively significantly decreased *C. trachomatis* infectivity rates by 39-55%. Likewise, the addition of the ER $\beta$  antagonist, tamoxifen, to cell cultures prior to infection with *C. trachomatis* caused a 30% decrease in infectivity when compared to unexposed controls, suggesting that mERs are important for successful EB entry into host cells. Significant decreases in infectivity (44-90%) were also observed when tamoxifen was added to cultures at various times after *C. trachomatis* infection, suggesting that signaling via estrogen receptors is important for proper chlamydial inclusion development within the host. Overall, the data from our current study support the hypothesis that estrogen and its receptors play a dual role in chlamydial infection: i) mERs appear to aid in entry of chlamydial EBs into the host cell and ii) signaling by mERs may contribute to inclusion growth within the host during *C. trachomatis* infection.

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## **EARLY PREDICTORS OF COMPLIANCE IN SLEEP APNEA PATIENTS TREATED WITH CONTINUOUS POSITIVE PRESSURE AIRWAY PRESSURE**

Justin R. Moore<sup>1</sup>, MD, George Zaldivar<sup>2</sup>, MD, Adam Haider<sup>2</sup>, MD, Sameer Bellaprapavalu<sup>2</sup> MD, Taral Patel<sup>2</sup>, MD, Cristian Sirbu<sup>2</sup>, MD, PhD. Hani Nazha<sup>2</sup>, MD, Khurram Shaikh<sup>2</sup>, MD, James Griffith<sup>2</sup>, MD, FACP, Fahd Zarrouf<sup>3</sup>, MD, Patrick Macmillan<sup>1</sup>, MD, Hetal Brahmbhatt<sup>1</sup>, MD, Steve Loyd<sup>1</sup>, MD

<sup>1</sup> Department of Internal Medicine, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

<sup>2</sup> Charleston Division of Internal Medicine, West Virginia University, Charleston, WV

<sup>3</sup> Department of Internal Medicine, Cleveland Clinic, Cleveland

Effectiveness of Continuous Positive Airway Pressure (CPAP) as a treatment for Obstructive Sleep Apnea (OSA) can be limited by poor compliance. Our goal is to explore retrospectively the effect of 41 pre-CPAP predictors, individually and in combinations, on short term compliance. We plan to specify a combination of factors that may predict with high sensitivity and specificity high-risk population for non-compliance and to target this group with early intervention. 190 subjects were included. All adult OSA patients with available compliance cards following with our sleep center were included. The database was reviewed for suggestive pre-CPAP predictors including demographic data, medical, mental and substance abuse history, physical exam, and other possible predictors of PSG findings. The relationship between the predictors and three compliance measures (average hours of device use, percent of days more than 4 hours of use and percent of days the device was used) were investigated using Pearson correlation coefficient, independent sample t-test and one way ANOVA. 190 subjects were included in the final analysis, 80 females (42.1%). Age range was between 20 and 89, Mean age = 49.89 (12.21). Male gender and living with a spouse correlated with significantly higher number of hours of CPAP use ( $p=0.02$  and  $0.03$ ) but not with the other two measures of compliance. Previous palatal surgery correlated significantly with percent of days the device was used  $\geq 4$  hrs ( $p=0.037$ ). Apnea Hypopnea Index (AHI) correlated positively and significantly with the three measures of compliance ( $p=0.04$ ,  $p=0.006$ , and  $p=0.019$ ). Lowest SaO<sub>2</sub> correlated negatively and significantly with compliance. Other predictors are discussed individually and in combination. Female gender, living alone, no previous palatal surgery, lower AHI number, and lowest SaO<sub>2</sub> during PSG predicted early CPAP non-compliance. We suggest a pre-CPAP evaluation form to predict compliance with accepted sensitivity and specificity and are in the process of collecting more data.

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## **IDENTIFICATION AND BIOCHEMICAL ANALYSIS OF SECONDARY PRODUCT GLUCOSYLTRANSFERASES OF *CITRUS PARADISI***

Daniel K. Owens<sup>1</sup> and Cecilia A. McIntosh<sup>1,2</sup>

<sup>1</sup>Department of Biological Sciences, College of Arts and Sciences, East Tennessee State University, Johnson City, TN

<sup>2</sup>School of Graduate Studies, East Tennessee State University, Johnson City, TN

Flavonoids are polyphenolic secondary metabolites which are ubiquitous in higher plants and are critical for plant survival in such roles as UV photoprotection, pigmentation, as well as symbiont and pathogen interactions. Limonoids are triterpenoid secondary metabolites that appear to act as antifeedants in plants. In Citrus, the glycosylation of flavonoids and limonoids is of particular interest as it directly impacts the taste characteristics, and thereby the marketability, of fruits and juices. Glycosylation is a prominent modification reaction which serves a number of roles including: stabilizing structures, affecting the solubility and transport of compounds, and regulating bioavailability. The enzymes that catalyze glycosylation are known as glucosyltransferases (GTs) and typically accomplish this task by transferring a UDP-activated glucose to a corresponding acceptor molecule. Plant secondary metabolism GTs share a conserved 44 amino acid residue motif known as the plant secondary product glucosyltransferase (PSPG) box which represents the UDP-sugar binding domain. The PSPG box was used as a marker to locate secondary product glucosyltransferases of Citrus paradisi by using bioinformatic approaches to search the limited available sequence data and by “fishing” against cDNA libraries with degenerate PSPG box primers. The putative glucosyltransferases identified by these approaches are being optimized for recombinant expression in E.coli and screened for biochemical activity. One clone has been established as

a flavonol 3-O-GT by thorough kinetic analysis. Two additional clones have identifiable enzyme activity with the flavonoid substrate quercetin. Of these, one has 100% identity with a predicted limonoid glucosyltransferase and we are in the process of biochemically testing the enzyme for this activity.

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### **CHRONIC GRANULOMATOUS DISEASE WITH MCLEOD PHENOTYPE, A CASE REPORT**

Hardik Parekh, MD<sup>1</sup>, MPH, Demetrio Macariola, MD<sup>2</sup>, Gayatri Balasubrahmanyam, MD<sup>2</sup>,

<sup>1</sup>Department of Family Medicine,

<sup>2</sup>Department of Pediatrics,

East Tennessee State University, Johnson City, TN

Chronic Granulomatous Disease (CGD) is an immunodeficiency disease characterized by defects in phagocyte NADPH oxidase enzyme complex, resulting in decreased microbicidal activity against catalase-positive bacteria and fungi. X-linked CGD caused by interstitial deletion can also have deletion of the adjacent Kell locus on X chromosome, causing CGD with McLeod phenotype. Through our case report, we hope to create awareness among clinicians about presentations of CGD. We admitted a two year old white male with history of intermittent fever for three months and a skin ulcer on thigh. His past medical history included recurrent pneumonias, last episode was due to *Klebsiella pneumoniae*, microcytic hypochromic anemia, and Gastro-Esophageal Reflux Disease. His father had recurrent pneumonias in childhood. On examination he had a temperature of 100.9F and 2x4 cm skin ulcer with erythema on right thigh. His laboratory results included high White Blood Cell count (20.5), low Hemoglobin/Hematocrit (6.8/22.8), low Mean Corpuscular Volume (60.8), high Erythrocyte Sedimentation Rate (71 mm/h), high C-Reactive Protein (18.1), low serum iron and normal TIBC and transferrin. Infectious disease workup was negative (for HIV, EBV, CMV, Bartonella, RSV, and influenza). From the ulcer coagulase negative Staphylococcus were isolated. Blood group was O+, and Kell antigen negative. Whole body bone scan were normal. Chest CT scan showed multiple pulmonary nodules. Lung biopsy showed nodular necrotizing granulomas without fungus or bacteria. The final diagnosis was made by Neutrophil Oxidative Burst Assay that was consistent for CGD. He received antibiotics for cutaneous ulcer and Kell negative blood transfusion for anemia. He improved and was discharged on prophylactic Trimethoprim/Sulfamethoxazole (antibiotic), Itraconazole, Interferon-gamma, and Intravenous iron. He was then referred to National Institute of Health for possible bone marrow transplantation. This case highlights the importance of maintaining a high index of suspicion, that when a common infection becomes recurrent, immunodeficiency syndromes such as CGD need to be considered. Laboratory work up to confirm the diagnosis of immunodeficiency syndrome such as CGD are available in our locality.

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### **MANNOSE BINDING LECTIN (MBL) MUTATIONS, IMMUNE DEFICIENCY ASSOCIATIONS AND HUMAN DISEASE**

M.B. Pate, D. S. Chi, C. Miller, V. Damarla, G. Krishnaswamy, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

**Rationale:** MBL is a key serum protein for innate immunity, activating the lectin complement pathway to enable opsonophagocytosis of pathogens. Patients with MBL deficiencies are more likely to develop recurrent infections, autoimmune disease and other comorbidities. Studies have estimated that about 5% of population has a MBL deficiency (<100 ng/mL). Decrease in MBL serum levels is due to single nuclear polymorphism in the MBL gene. **Methods:** Retrospective reviews of 23 patients with MBL deficiency (<100 ng/dL) was performed evaluating sex, immune function and comorbidities. Evaluation of MBL gene and mannose-binding protein-associated serine protease 2 (MASP2) was performed by genotyper molecular analysis. Study is IRB approved. **Results:** Of the 23 patients, 14 were female and 9 were male. Fifty two percent had abnormal immunoglobulin levels, decreased IgM and IgG being the most common

deficiency. Over half of the patients demonstrated very low MBL functional activity. Genotype testing confirmed mutations in these patients and identified many genetic variations: LXPA/LYPB (50%), LYPB/HYPD (22%), HYPD/HYPD (11%), LXPA/LYQC (5.5%), LXPA/LXPA (5.5%), LXPA/HYPD(5.5%). Of the 18 patients who were genotyped, 17 had a variant polymorphism. Six patients were homozygous for the variant allele and 11 patients were heterozygous. MASP2 analysis revealed the majority of patients had the wild type (A/A) MASP2 allele and 3 patients had a variant allele (A/G). Numerous complications were reported, with the most common including: sinusitis (83%), bronchitis (69%), osteoarthritis (61%), hypertension (39%), pneumonia (35%), multiple drug hypersensitivity (30%), degenerative disk disease (26%), and dyslipidemia (26%). One patient developed a severe pacemaker infection, one had cardiolipin syndrome, one bronchiectasis, 5/23 had skin infections (cellulites, folliculitis) and one had a thyroid nodule. Additionally, 52% of patients had an autoimmune disease. Conclusions: MBL deficiency has a heterogeneous presentation and the diagnosis may be easily missed, making it an important differential diagnosis in patients with multisystem disease and recurrent infections. MBL has been shown to be associated with infections and comorbidities and more research needs to be done to establish the connection. There is currently no treatment for MBL deficiency, but MBL replacement therapy is currently being evaluated in Phase I and II trials, which could be a novel treatment for severely affected patients.

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#### **ISOLATED CHYLOPERICARDIUM AND SUPERIOR VENA CAVAL SYNDROME FOLLOWING ATRIAL SEPTAL DEFECT/ PARTIAL ANOMALOUS PULMONARY VENOUS RETURN REPAIR**

Thomas M.Yohannan, M.D.<sup>1</sup>, Thomas Doyle, M.D.<sup>2</sup>, Davis Drinkwater, M.D.<sup>3</sup>, and Rajani Anand, M.D.<sup>4</sup>

<sup>1</sup>Department of Pediatrics, East Tennessee State University Johnson City, TN

<sup>2</sup>Division of Pediatric Cardiology, Monroe Carell Children's Hospital at Vanderbilt University, Nashville, TN

<sup>3</sup>Division of Cardiothoracic Surgery, Centennial Medical Center, Nashville, TN

<sup>4</sup>Division of Pediatric Cardiology, East Tennessee State University Johnson City, TN

A 22 month old male presented to the cardiology office with facial swelling and increasing dyspnea of one week duration. Four weeks prior to presentation, the patient had undergone operative repair of ostium secundum atrial septal defect and partial anomalous pulmonary venous return by superior vena caval transection and anastomosis of the superior portion of the superior vena cava to the right atrial appendage and baffling the inferior portion of the superior vena cava and the right upper pulmonary vein to the left atrium. Physical exam revealed an afebrile, tachycardic, toddler with muffled heart sounds. An ECHO demonstrated a large pericardial effusion with right ventricular free wall collapse and significant narrowing at the superior venacaval/right atrial junction. The child was taken to the OR where 50 ml of chylous pericardial fluid was drained. The child was transferred to the facility of original surgical repair and the superior venacaval(SVC) obstruction was relieved with stent implantation. There was no reaccumulation of pericardial effusion and the child was discharged on post-op day 7. The child had elective stent redilatation at 14 months post-implant. He remains asymptomatic 2½ years since initial presentation. English language literature in Pubmed was searched for key words “chylopericardium” and “SVC obstruction after congenital cardiac surgery”. Only case reports of isolated chylopericardium following congenital cardiac surgery in children less than 18 years were considered in the review. Cases with combined chylothorax and chylopericardium were discarded. 18 cases of isolated chylopericardium complicating congenital cardiac surgery in children under 18 years of age have been reported in 9 publications. Isolated chylopericardium is an extremely rare complication of congenital cardiac surgery with an incidence of less than 0.2%. The first case was reported by Louhimo and associates in 1966. The causes of this complication include direct injury to the thoracic duct, mediastinal lymphatic vessels and thymus. High venous and lymphatic pressures secondary to brachiocephalic venous thromboses and superior vena caval (SVC) obstruction have also been postulated as factors. The SVC obstruction in our patient resulted in elevated central venous and lymphatic pressures with resultant chylopericardium. The causal relationship of isolated chylopericardium and SVC obstruction is important in prompt diagnosis and

definitive treatment. Our case report illustrates the association between isolated chylopericardium and SVC obstruction after congenital cardiac surgery. This is the first report of successful treatment of isolated chylopericardium with percutaneous stent relief of SVC obstruction.

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### **CROSS-TALK BETWEEN PD-1 AND SOCS-1 IN HCV CORE-MEDIATED IL-12 INHIBITION**

Ying Zhang<sup>2</sup>, Cheng J. Ma<sup>2</sup>, Lei Ni<sup>2</sup>, Xiao Y. Wu<sup>2</sup>, Jonathan P. Moorman<sup>1,2</sup> and Zhi Q. Yao<sup>1,2</sup>

<sup>1</sup>Medical Service, Department of Veterans Affairs, Veterans Affairs Medical Center, Johnson City, TN,

<sup>2</sup>Department of Internal Medicine, Division of Infectious Diseases, Quillen College of Medicine, East Tennessee State University, Johnson City, TN

HCV is a serious and growing threat to public health concern affecting approximately 200 million people worldwide. The majority of individuals exposed to HCV become persistently infected and develop chronic hepatitis, which may progress to liver cirrhosis and hepatocellular carcinoma. In studying mechanisms for HCV persistence in humans, HCV core has been identified as an immunomodulatory protein that suppresses a variety of cell responses including the production of IL-12 by monocyte/macrophages (M/M<sub>φ</sub>) through its interaction with a complement receptor, gC1qR. We have also shown that PD-1 and SOCS-1, two newly identified negative immunomodulators, are involved in the HCV core/gC1qR-mediated T and B lymphocyte dysregulation. The role of PD-1/SOCS-1 in HCV core-mediated IL-12 suppression remains unknown. In this study, we first analyzed the association of HCV core-induced PD-1 and SOCS-1 expression and IL-12 suppression in both primary M/M<sub>φ</sub> isolated from chronically HCV-infected patients and healthy subjects, and in human monocytic cell line THP-1. Compared with healthy subjects, PD-1 and SOCS-1 expression was found increased that is correlated to the decreased IL-12 secretion in chronically HCV-infected patients. PD-1 and SOCS-1 expression was augmented, along with IL-12 further inhibited, in M/M<sub>φ</sub> treated with HCV core protein in healthy subjects as well as HCV-infected patients. Interestingly, blockade of gC1qR could rescue the HCV-core-induced PD-1 up-regulation and IL-12 suppression in M/M<sub>φ</sub> in response to Toll-like receptor (TLR) stimulation. Additionally, blocking PD-1 pathway using specific antibodies could enhance IL-12 production by reducing the expression of SOCS-1 molecule induced by HCV core protein; and conversely, silencing SOCS-1 gene by small interfering RNA (isRNA) could promote IL-12 secretion through inhibiting PD-1 molecule, suggesting that PD-1 and SOCS-1, two inhibitory molecules seemingly function at different levels, are actually linked each other inside the cells. Activation of the signal transducer and activator of transcription 1 (STAT-1) is involved in the improvement of IL-12 in M/M<sub>φ</sub> with PD-1 blocking or SOCS-1 silencing. This study indicates that HCV core/gC1qR engagement on M/M<sub>φ</sub> triggers the expression of PD-1 and SOCS-1, which could cross-talk and coordinately work together to deliver negative signaling to the TLR-mediated pathway for IL-12 suppression and to facilitate HCV persistence. Our study provides a novel mechanism by which pathogen usurps host machinery to establish chronic infection, and a rationale for designing therapeutics and vaccine strategies for chronic HCV infection.

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# 2009 ASRF Award Winners

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## Poster Presentations

### Division I – Undergraduates

#### Arts & Humanities and Biomedical Sciences

**First Place:** James Fisher, ETSU.

Faculty Sponsor: Dr. Michael F. Wempe, Dept. of Chemistry.

*THE SYNTHESIS OF TAK-242 (ETHYL 6-[(2-CHLORO-4-FLUOROPHENYL)SULFAMOYL]CYCLOHEX-1-ENE CARBOXYLATE: A SMALL-MOLECULE ANTISEPSIS AGENT*

**Second Place:** Chris Daniels, ETSU.

Faculty Sponsor: Dr. Robert Schoborg, Dept. of Microbiology.

*CELL-ADHESION MOLECULES (CAM'S) AND ASSOCIATED PROTEINS ARE DOWN-REGULATED IN CHLAMYDIA TRACHOMATIS AND CHLAMYDIA MURIDARUM INFECTED HE LA CELLS*

#### Natural Sciences & Mathematics

**First Place:** Wenzong Li, ETSU.

Faculty Sponsor: Dr. Zulfiqar Ahmad, Dept. of Biological Sciences.

*IDENTIFICATION OF PHOSPHATE BINDING IN ESCHERICHIA COLI ATP SYNTHASE*

**Second Place:** Justin Quinn, Carson-Newman College.

Faculty Sponsor: Christine Dalton, Dept. of Chemistry.

*OPTIMAL EXTRACTION OF NITROGEN CONTAINING DISINFECTION BYPRODUCTS FROM DRINKING WATER THROUGH SOLID PHASE MICROEXTRACTION*

#### Social & Behavioral Sciences

**First Place:** Benjamin Hughes, ETSU.

Faculty Sponsor: Dr. Russell Brown, Dept. of Psychology.

*A DOSE-RESPONSE ANALYSIS OF METHYLPHENIDATE SENSITIZATION IN ADOLESCENT RATS: SEX DIFFERENCES IN LOCOMOTOR ACTIVATION*

**Second Place:** Desta Taylor, ETSU.

Faculty Sponsor: Dr. Stacey L. Williams, Dept. of Psychology.

*PERCIEVED CONTROL: A MECHANISM EXPLAINING INTIMATE PARTNER VIOLENCE OUTCOMES*

## **2009 ASRF Award Winners (cont.)**

**Third Place (tie): Benjamin Martin**, ETSU.

Faculty Sponsor: Dr. Chris Dula, Dept. of Psychology.

*GETTING UNDER THE SKIN: THE DEVELOPMENT OF THE MARTIN STIGMA AGAINST TATTOOS SCALE*

**Third Place (tie): Treston Wheat**, UT-K.

Faculty Sponsor: Dr. Michael Fitzgerald, Dept. of Political Science.

*FRUITS OF WAR: TO WHAT EXTENT DID ISRAEL WIN THE SECOND LEBANON WAR?*

**Division II – Graduate Students, 1-2 Years**

### *Arts & Humanities and Biomedical Sciences*

**First Place: Ashley Frazier**, ETSU.

Faculty Sponsor: Dr. Jonathan P. Moorma, Dept. of Internal Medicine.

*BLOCKING OF THE PROGRAMMED DEATH-1 PATHWAY IN HEPATITIS C VIRAL INFECTION LEADS TO A DOWN-REGULATION OF SUPPRESSOR OF CYTOKINE SIGNALING-1*

**Second Place: Anna Swisher**, ETSU.

Faculty Sponsor: Dr. Michael H Stone, Dept. of KLSS.

*RELATIONSHIP OF STRENGTH, AND POWER CHARACTERISTICS TO OVERHEAD SHOT THROW PERFORMANCE IN NCAA DIVISION I MALE THROWERS*

### *Natural Sciences & Mathematics*

**First Place: Byron Van Nest**, ETSU.

Faculty Sponsor: Dr. Darrell Moore, Dept. of Biological Sciences.

*'SHOULD I STAY OR SHOULD I GO?' INDIVIDUAL DECISION MAKING IN THE HONEY BEE (*APIS MELLIFERA*) FORAGER OPTIMIZES GROUP FORAGING EFFORTS*

**Second Place: Diwaker Tripathi**, ETSU.

Faculty Sponsor: Dr. Dhirendra Kumar, Dept. of Biological Sciences.

*ROLE OF SALICYLIC ACID BINDING PROTEIN 2 IN SYSTEMIC ACQUIRED RESISTANCE INDUCED BY ACIBENZOLAR-S-METHYL*

### *Social & Behavioral Sciences*

**First Place: Angela Enlow**, Fielding Graduate University.

Faculty Sponsor: Dr. Jodi Polaha, ETSU Dept. of Psychology.

*EVALUATING INTEGRATED PEDIATRIC WELL VISTS IN APPALACHIAN TENNESSEE*

**Second Place: Jessica Smith**, ETSU.

Faculty Sponsor: Dr. Russ Brown, Dept. of Psychology.

*ESZOPICLONE FACILITATION OF THE ANTIDEPRESSANT EFFICACY OF FLUOXETINE USING A SOCIAL DEFEAT STRESS MODEL IN THE MOUSE*

## **2009 ASRF Award Winners (cont.)**

### **Division III – Graduate Students, 2+ Years**

#### **First Place: Theresa Pickle, ETSU.**

Faculty Sponsor: Dr. Douglas Thewke, Dept. of Biochemistry and Molecular Biology.  
*A CANNABINOID (WIN 55,212-2) INDUCES APOPTOSIS IN PANCREATIC TUMOR CELLS*

#### **Second Place: Jala Daniel, ETSU.**

Faculty Sponsor: Dr. Cecilia McIntosh, Dept. of Biological Sciences.  
*DETERMINING PUTATIVE SECONDARY PRODUCT GLUCOSYLTRANSFERASE EXPRESSION DURING CITRUS PARADISI GROWTH AND DEVELOPMENT*

### **Division IV – Medical Students**

#### **First Place: James Thompson, ETSU.**

Faculty Sponsor: Dr. Alok Agrawal, Dept. of Pharmacology.  
*TARGETING C-REACTIVE PROTEIN TO CAPTURE ATHEROGENIC LDL*

#### **Second Place: Jennifer Chavis, ETSU.**

Faculty Sponsor: John 'Trey' Robertson M.D., John Lawson Surgical Group, Johnson City, TN.  
*ENTEROCOLIC LYMPHOCYTIC PHLEBITIS INITIALLY PRESENTING AS INTUSSUSCEPTION IN AN ADULT: A CASE REPORT*

### **Divisions V & VI – Med. Residents & Post-Docs and Cast Histories**

#### **First Place: James Reed, ETSU.**

Faculty Sponsor: Howard E. Herrell, M.D., Dept. of OB/GYN.  
*INFLUENCE OF BODY MASS INDEX, HEIGHT, AND AGE ON THE MODE OF DELIVERY IN NULLIPAROUS WOMEN IN APPALACHIA*

#### **Second Place: Hao Pham, ETSU.**

Faculty Sponsor: Tony Katras, M.D., Dept. of Surgery.  
*SIMULTANEOUS REPAIR OF THORACIC AND INFRARENAL ABDOMINAL AORTIC ANEURYSMS USING ENDOVASCULAR STENT GRAFTS*

## Oral Presentations

### Graduate Students

**First Place:** Preston Visser, ETSU.

Faculty Sponsor: Dr. Jameson K. Hirsch, Dept. of Psychology.

*DISPOSITIONAL OPTIMISM AS A MEDIATOR OF THE RELATIONSHIP BETWEEN ETHNIC IDENTITY AND DEPRESSIVE SYMPTOMS*

**Second Place:** Stacie Woolard, ETSU.

Faculty Sponsor: Dr. Uday Kumaraguru, Dept. of Microbiology.

*REPROGRAMMING OF IMMUNE RESPONSE IN LATENT HSV INFECTION*

### Medical Residents and Post-Doctoral Fellows

**First Place:** Venkataramanan Gangadharan, ETSU.

Faculty Sponsor: Dr. Thomas Roy, Dept. of Internal Medicine.

*ORGANIZING PNEUMONIA WITH MYELODYSPLASTIC SYNDROME: A RARE ASSOCIATION*

**Second Place:** Umbar Ghaffar, ETSU

Faculty Sponsor: Catherine Shuttle, Dept. of Internal Medicine.

*THE HIDDEN DIARRHEA CULPRIT: LYMPHOCYTIC COLITIS*