7-25-2013

# 2013 UAB Summer Research Expo

University of Alabama at Birmingham

# UAB Summer Research Expo


## July 25, 2013

# WELCOME

Welcome to the **2013 Summer Research Expo**. This year's students have completed a wide array of projects, and we are confident that their work this summer will prove to be a step toward a promising future. Many thanks go out to the mentors who have overseen this summer's projects, as well as the judges who must select award recipients from the work presented today.

The undergraduate programs represented are UAB Justice Sciences Crime Research Experiences for Undergraduates (REU), UAB Department of Physics Research Experiences for Undergraduates (REU), Summer in Biomedical Sciences (SIBS) Undergraduate Research Program, and the Minority Health & Health Disparities Research Center's Summer Enrichment Program. In all, there are 84 student participants from a variety of academic backgrounds. We hope that today's competing scholars continue their excellent work throughout their academic careers and beyond.

# SCHEDULE

**Thursday, July 25, 2013**
**The Edge of Chaos**

| | |
|---|---|
| Poster Set-up | 8:00 - 8:25 a.m. |
| Judging of Posters | 8:30 - 10:30 a.m. |
| Guest Speaker (Volker Hall Lecture Room C) | 10:45—11:45 a.m. |

Dr. David Sweatt —Chair, Department of Neurobiology at University of Alabama at Birmingham

"Epigenetic Mechanisms in Memory Formation"

| | |
|---|---|
| Awards Ceremony | 11:45—12:15 a.m. |
| (poster removal—after awards) | |

# 2012 Summer Research Expo Award Recipients

## Life Sciences I

| | | | |
|---|---|---|---|
| Valentine Nwachukwu<br>1st Place | Dominique Tull &<br>Laura Aristizabal<br>2nd Place | Ariella Jackson<br>3rd Place | Deborah Craddock &<br>Rebecca Duron<br>Honorable Mention |

## Life Sciences II

| | | | |
|---|---|---|---|
| Morgan Jackson<br>1st Place | Khadijah Aleem<br>2nd Place | B. J. Ammons & Pau-<br>leatha Diggs<br>3rd Place | Cala Marie Penn<br>Honorable Mention |

## Life Sciences III

| | | | |
|---|---|---|---|
| Kendra J. Royston<br>1st Place | Lindy Pence<br>2nd Place | Tanu Patel<br>3rd Place | Meg Apperson<br>Honorable Mention |

## Social & Behavioral Sciences and Public Health – Session I

| | | | |
|---|---|---|---|
| Shannon Denny<br>1st Place | Clint Strickland<br>2nd Place | Joshua Harris<br>3rd Place | Sierra Nicely<br>Honorable Mention |

## Social & Behavioral Sciences and Public Health – Session II

| | | | |
|---|---|---|---|
| Melissa Walters<br>1st Place | Logan C. Holmes<br>2nd Place | Michelle Ocampo<br>3rd Place | Briauna Knott<br>Honorable Mention |

## Physical Sciences and Engineering I

| | | | |
|---|---|---|---|
| Patrick Marino<br>1st Place | Aditi Naik<br>2nd Place | Phillip Wall<br>3rd Place | Zachary Palchak &<br>Stephanie Jacobs<br>Honorable Mention |

## Physical Sciences and Engineering II

| | | | |
|---|---|---|---|
| Jerome Arceneaux<br>1st Place | Sean Severson<br>2nd Place | Roman Garcia<br>3rd Place | Lauren Guimond<br>Honorable Mention |

# TABLE OF CONTENTS

## Life Sciences

# Life Sciences

# Life Sciences

# Physical Sciences and Engineering

# Physical Sciences and Engineering

# Public Health and Social & Behavioral Sciences

# Service Learning & Honors Academy Leadership Projects

**Life Sciences —Exhibit 1**

**Danielle Ballard, Nicole Pettofrezzo**
University of Indianapolis
Crime Research Experience for Undergraduates (REU)
Mentor(s): Jason Linville, Ph.D.
Coauthor(s): Nicole Pettofrezzo, Florida State University

## Testing the Stability of a Primer Mixture in an STR Multiplex Reaction: An Efficient Alternative Kit for Teaching and Research Purposes

Current forensic laboratories analyze DNA from suspects and victims with an amplification kit that costs around $22 per reaction. This type of kit can produce a genetic profile that uniquely matches an individual. The high costs and specificity of this kit are impractical and unnecessary for teaching and research labs. It would be ideal for educational facilities to run less expensive multiplex reactions with only a few loci rather than all 13 loci analyzed in professional laboratories. Creating a personalized kit with separately purchased reagents is a more feasible option that increases efficiency by lowering the cost. This project focuses on combining six different primers into one mixture that can be stored over time and used in a three-step kit for polymerase chain reaction (PCR) reactions. In previous research, ineffective amplification was observed after using a primer mixture that was stored for 48 hours. The purpose of this study was to monitor the viability of the primer mixture over time and to determine the effects of various storage conditions. Attributing amplification failure to the primer mixture was not supported through the results of this investigation, based upon the primer mixture effectively amplifying DNA after being stored at freezing temperature for up to one week. Alternative storage options for the mixture, including storage at room temperature and exposure to light, were explored. Storing a primer mixture at -20°C is effective at amplifying DNA for use in an educational kit.

**Life Sciences —Exhibit 2**

**Meredith Barefield**
University of Southern Mississippi
Summer in Biomedical Sciences (SIBS)
Mentor(s): Eddy S. Yang, M.D., Ph.D.

## Differential susceptibility of HPV positive and negative head and neck cancers to EGFR and PARP inhibition

The human papilloma virus (HPV) has recently become a prevalent cause of head and neck cancer (HNC). We previously reported that in non-HPV-associated HNC cell lines combined inhibition of epidermal growth factor receptor (EGFR) and poly (ADP-ribose) polymerase (PARP) with cetuximab and veliparib, respectively, resulted in the greatest cell kill versus either agent alone in vitro. In this study, we evaluated the in vitro and in vivo response of HPV-associated HNC to combined EGFR and PARP inhibition. HPV-associated SCC-47 and SCC-90 HNC cell lines as well as a human tumor explant from a patient with HPV+ HNC were utilized for these studies. Interestingly, HPV-associated HNCs exhibited the greatest sensitivity to veliparib alone and demonstrated reduced sensitivity to cetuximab both in vitro and in vivo. Surprisingly, HPV-associated HNC cells also had a basal DNA repair defect as measured by radiation induced rad51 foci, a well-characterized marker of homologous recombination repair. This may be due to reduced FANCD1 (BRCA2) and FANCD2 proteins. FANC proteins have various functions in DNA damage response and repair, and FANCD1/BRCA2 is a well-known determinant of tumor sensitivity to PARP inhibition. Furthermore, knockdown of the HPV oncoprotein E7 restored FANCD1(BRCA2) expression. Taken together we hypothesize HPV-associated head and neck cancers susceptibility to PARP inhibition alone may be due to E7-mediated suppression of BRCA2. The results from our study warrant further testing of PARP inhibitors as part of HNC therapy as well as this further elucidation of the potential connection between HPV, Fanconi Anemia, and HNCs.

**Life Sciences —Exhibit 3**

**Susanna Basappa**
University of San Francisco
Summer in Biomedical Sciences (SIBS)
Mentor(s): Sadis Matalon, Ph.D.
Coauthor(s): Zhihong Yu, Cilina Rodriguez, Jaideep Honavar, Michael Clark, Stephen Doran

## The Effects of Heparin Aerosol on Chlorine Induced Lung Injury

Chlorine (Cl2) is powerful oxidant that irritates the lungs. It is used in large quantities daily, but can cause Acute Lung Injury (ALI) when inhaled at high concentrations, as in Cl2 transportation train derailments. Accordingly, compounds such as heparin are being tested for chlorine-injury attenuating effects. Heparin is an anti-coagulant that prevents fibrin deposition, increases nitric oxide (NO) availability (anti-inflammatory and antioxidant), and causes no significant systemic bleeding when administered locally. Because of these beneficial effects, it was hypothesized that the mice receiving heparin following chlorine exposure would show significantly lower levels of lung damage than mice exposed to chlorine alone. To test the effects of heparin following Cl2 exposure, air and Cl2 groups received an aerosol post-exposure (heparin or saline). The chlorine exposed mice received 400ppm Cl2 for 30 minutes, and all mice received an aerosol for 20 minutes immediately post-exposure. Post-aerosol, blood was taken for TAT and ROTEM measurements and bronchoalveolar lavages (BAL) were taken for protein concentration measurements and cell counts. Another set of mice were mechanically ventilated to test resistance, elastance and Newtonian resistance in the lungs. The Mann-Whitney test was used to determined significant difference between groups. Results indicated that heparin decreased the total amount of WBCs, particularly neutrophils, recruited to the lungs. Analysis of protein levels indicated that heparin does not reduce increased lung permeability to protein. ROTEM measurements indicated that heparin did not decrease clotting time and clot formation time in the blood. TAT measurements are forthcoming. Mechanical ventilation indicated that heparin does not affect resistance, elastance or Newtonian resistance in the lungs. These results suggest that heparin mitigates certain forms of Cl2 induced lung damage, particularly neutrophil recruitment following injury.

**Life Sciences —Exhibit 4**

**Katherine Beaufait**
University of Alabama at Birmingham
Mentor(s): Dr. Nicole Riddle

## Use of transcription activator-like effector endonucleases (TALENs) to introduce single amino acid changes in Drosophila melanogaster HP1a, HP1B, and HP1C.

Heterochromatin Protein 1 (HP1) was first found in the Drosophila melanogaster, but its homologs are now known to exist in fungi, plants, and other animals. Proteins of the HP1 family have various roles including gene silencing functions. For example, they can mediate the spread of heterochromatin to euchromatic transgenes and are involved in the maintenance and function of the fly's heterochromatin. While the functions of HP1a and HP1C have been described, HP1B's function is still unknown. Dimerization is a critical aspect of HP1a's function, and it depends on amino acid 191. We will introduce single amino acid changes that prevent dimerization into the three Drosophila HP1 proteins: I191E in HP1a, I143E in HP1B, and I129E in HP1C. To introduce the mutation, transcription activator-like endonucleases (TALENs) along with a donor DNA molecule carrying the desired mutation will be injected into fly embryos. TALENs introduce a double stranded break in the genomic DNA at a specified site that is then repaired by homologous recombination using the donor molecule as template. After introducing the mutation polymerase chain reaction (PCR) analysis will be used to ensure the mutation actually occurred in the desired codon sequence. Here the progress on donor plasmid construction, TALEN generation, and TALEN expression are reported along with goals of the project. The Drosophila lines that will be created from this project will be useful in helping describe HP1B's function and give us an opportunity to look at HP1a and HP1C's function in a new manner.

**Life Sciences —Exhibit 5**

**Sheila Bhavsar**
University of Georgia
Summer in Biomedical Sciences (SIBS)
Mentor(s): Andrew West, Ph.D. and Mark Moehle

## LRRK2 Role in Neuroinflammation Associated with Parkinson's Disease

Parkinson's Disease (PD) is the second most common neurodegenerative disorder characterized by bradykinesia, rigidity, ataxia, and an at-rest tremor. In addition, a key feature of PD is the presence of Lewy bodies in susceptible neurons of the brain, which are protein aggregates that consist primarily of α-synuclein. Affected areas of the brain also contain inflammatory cells of the immune system. Leucine-rich repeat kinase 2 (LRRK2), a multi-domain protein kinase, has recently been linked to PD susceptibility. Autosomal dominant missense mutations in the GTPase domain or in the kinase domain of LRRK2 are the most common genetic causes of PD. LRRK2 is highly expressed in antigen-presenting cells of the immune system (e.g. macrophages), suggesting that LRRK2 may play a role in neuroinflammation associated with PD. It is thought that activating mutations in LRRK2 may enhance neuroinflammatory responses induced by the brain's microglia. Therefore, we studied this speculation further in a rat model, in which brain tissue was collected from transgenic rats over-expressing LRRK2 and α-synuclein. The tissue was specifically collected from the substantia nigra, a region particularly susceptible in PD, and also rich in LRRK2 and α-synuclein expression. This tissue was analyzed by immunofluorescence and immunohistochemistry for markers specific to both neurons and immune system cells. Analyzing these tissues will help determine whether LRRK2 alters neuroinflammation relevant to α-synuclein related neurodegeneration in PD.

**Life Sciences —Exhibit 6**

**Alexander Brookins**
University of Alabama at Birmingham
Mentor(s): Robert E. Sorge
Coauthor(s): Savannah L. Dewberry

## The role of the inflammasome in acute pain sensitivity

The inflammasome is a multi-protein multicellular complex that is directly involved in the production of the primary pro-inflammatory cytokine interlukin-1b (IL-1β). The increased production of this cytokine increases sensitivity in order to minimize harm to the targeted area. This activation is achieved through a myriad of pathways, each distinct inflammasome assembly triggered by different activators.
**Subjects:** Knockout mice (Genentech Inc.) lacking IPAF (ipaf, IPAF-/-), ASC (asc, ASC-/-), AIM2 (aim2, AIM2-/-) were used along with wild type controls (C57BL/6).
**Assays:** Hargreaves' radiant heat paw withdrawal test (at 15 % and 20 % maximum intensity), tail withdrawal (at temperatures of 47°C and 49°C), and hot plate (at temperatures of 53°C and 55°C) were conducted to test thermal sensitivity. The von Frey assay using and up down 50 % threshold method was used to measure mechanical sensitivity.
**Results:** This array of tests found a patterned disparity between the reaction time in the strains of knockouts when compared to the wild type with knockouts generally being less sensitive to thermal stimuli. This is unexpected, as all the tests recorded a response to acute pain, presumably without activating the inflammatory response.
**Future Directions:** This difference in sensitivity is likely the result of differing physiology between strains, and further testing including chronic pain tests using Complete Freund's Adjuvant (CFA) and formalin injections may lead to greater insight into this disparity.

**Life Sciences —Exhibit 7**

**Kaitlyn Brown**
University of Alabama at Birmingham
Mentor(s): Tom Harris

## The effect of TGF-β stimulation on CFTR function in cystic fibrosis

Cystic fibrosis (CF) is an autosomal recessive genetic disorder caused by mutations in the cystic fibrosis transmembrane conductance receptor (CFTR) gene. CFTR is a transmembrane protein and chloride channel present in the membranes of cells producing mucus, sweat, saliva, tears, and digestive enzymes. The transport of chloride ions across the cell membrane influences the movement of water in tissues and thus the production of mucus that lubricates and protects the lining of various passageways in the body. Individuals affected by CF have mutated copies of their CFTR gene leading to a significant reduction or loss of CFTR function. This results in the thick, sticky mucus characteristic of CF due to impaired hydration of airway mucosa. Our research looks at the relationship between transforming growth factor (TGF)-beta and CFTR synthesis in bronchial cells. TGF-β is a cytokine that is frequently elevated in CF patients. We are interested in comparing the effects of TGF-β stimulation on gene products of CF and non-CF bronchial epithelial and fibroblast cells. This project involved growing 2 cell lines each of epithelial and fibroblast cells in culture, then stimulating half of the samples with TGF-β for two hours while leaving the other half untreated as a control. Preliminary results show that TGF-β secretion and signaling increases in CF cells after stimulation compared to wild type controls. If TGF-β is proven to influence the efficacy of CF drugs, further investigation of TGF-β could pave the way for new developments in treatment.

**Life Sciences —Exhibit 8**

**Cole Bunn**
University of Alabama at Birmingham
Mentor(s): Farah D. Lubin PhD
Coauthor(s): R. Ryley Parrish, Farah D. Lubin PhD, Jasmyne S. Thomas, Kristen O. Riley MD

## Analysis of Hippocampal BDNF DNA Methylation Levels in Human Temporal Lobe Epilepsy

Temporal Lobe Epilepsy (TLE) is a neurological disorder characterized by recurrent, unprovoked seizures. Alteration in gene transcription in TLE is believed to be causal to the disorder. However, the molecular mechanisms associated with aberrant gene expression changes in TLE are uncertain. The Brain derived neurotrophic factor (Bdnf) gene has been shown to be abnormally expressed in epileptic tissue. Proper BDNF protein function is contingent upon an appropriate balance in Bdnf mRNA levels, and BDNF overexpression has been shown to exacerbate the epileptic phenotype. DNA methylation is a covalent chemical modification of DNA in which a methyl group is linked to the 5’ position of cytosine. This DNA modification is catalyzed by DNA methyltransferases and has been implicated in the regulation of gene transcription in the central nervous system. Therefore, we investigated whether there were alterations in Bdnf DNA methylation in resected hippocampal tissue from TLE patients. Using real-time polymerase chain reaction analysis, we found that Bdnf mRNA levels were significantly increased in resected TLE hippocampal tissue compared to lateral cortical tissue controls.Bisulfite sequencing revealed that altered DNA methylation strongly correlated with the altered BDNF gene transcription. Of the eleven possible CpG methylation sites assessed using bisulfite sequencing, three of the CpG sites showed significant elevated DNA methylation levels in the epileptic hippocampus compared to non-epileptic cortical tissue controls. Together, these results suggest abnormal Bdnf DNA methylation in TLE, indicating that this molecular transcriptional mechanism may serve as a novel therapeutic target to restore abnormal Bdnf mRNA levels in TLE.

**Life Sciences —Exhibit 9**

**Annessa Burnett**
Virginia Commonwealth University
Crime Research Experience for Undergraduates (REU)
Mentor(s): Dr. Beth Gardner

Purchasing Drugs Online, in Headshops, and in Gas Stations: Are you getting what you pay for?

The term "legal highs" refers to mind altering substances that have the same potential for abuse as a controlled substance. They are usually analogues of illicit substances, containing a small structural change that excludes them from existing regulations. In the case of the synthetic marijuana, they are often cannabinoid agonists, substances that interact with the CB1 And CB2 cannabinoid receptors. They are readily available to the public as "legal" recreational drugs. The synthetic cannabinoids UR-144, XLR-11, and A-796,260 were all found in "Spice" products purchased from head shops in the Birmingham, AL area during the summer of 2012. These three compounds are classified as cannabinoid agonists. As of 2012, these substances have been banned in the state of Alabama. P Both Stree Overlord and Black Ant were cited by the FDA for containing sildenafil, the active ingredient in Viagra. Black Ant was cited in 2011 and Stree Overlord in 2012. Sildenafil is a prescription drug and it was not listed in the ingredients on the packaging. Both drugs were purchased from a gas station outside of Gulf Shores in the summer of 2012. They were purchased again in June of 2013, from online vendors. Stree Overlord Strong was purchased from the same vendors. They were analyzed by GC-MS, LC-MS, and NMR. All the Stree Overlord and Stree Overlord Strong samples contained sildenafil or a sildenafil analog. Unlike Stree Overload, the samples of Black Ant did not contain sildenafil or anything except proteins and cellulose, detected by Fourier Transform Infrared Spectrometry (FT-IR).

**Life Sciences —Exhibit 10**

**Raymond Chang**
University of Maryland, Baltimore County
Summer in Biomedical Sciences (SIBS)
Mentor(s): Marcas Bamman, Ph.D.
Coauthor(s): Michael J. Stec

Blunted resistance training-induced muscle regrowth among atrophied older adults is associated with heightened inflammatory/proteolytic signaling

Resistance exercise training (RT) is widely used as a stimulus to improve function and promote muscle regrowth in atrophied older adults; however, the amount of RT-induced muscle regrowth is highly variable between individuals. The Bamman laboratory previously reported that older adults suffer muscle inflammation susceptibility – indicated primarily by heightened TNF-α/NFκB signaling – that may impair muscle regenerative capacity. Here we tested the hypothesis that levels of TNF-α/NFκB signaling may be associated with differential RT-induced muscle regrowth adaptations among older adults (n=66, 65.5 ± 3.6 y, 35wk RT). K-means cluster analysis grouped the subjects as non- (Non, n=25), modest (Mod, n=30), or extreme (Xtr, n=10) responders based on percent changes in thigh lean mass. Vastus lateralis biopsies were collected at baseline and after 35 weeks of RT for protein immunoblotting. Only Non experienced increases in phosphorylated NFκB p65 and caspase 3 levels after 35 weeks of RT, indicating increased inflammatory/proteolytic signaling. On the other hand, Mod and Xtr significantly decreased caspase 3 levels. Because muscle protein synthesis is thought to be regulated primarily at the level of translation initiation, we also assessed initiation signaling but found no compelling cluster differences in eIF2Bε or p70S6K signaling. These findings suggest levels of TNF-related signaling in skeletal muscle may play a role in determining the effectiveness of RT-induced muscle regrowth among older adults.

**Life Sciences —Exhibit 11**

**Amina Coghlan**
University of Alabama at Birmingham
Mentor(s): Greg Peek, Trygve Tollefsbol

## hTERT and Cancer

Most cancer cells depend on gene expression of the catalytic subunit of telomerase (hTERT) for their immortality, the capacity for an unlimited number of cell divisions. The transcription of hTERT is regulated by multiple pathways, including the TGF-b pathway which suppresses hTERT transcription and the Akt pathway which intervenes in multiple pathways to activate hTERT transcription. To overcome redundancy in the transcription regulation network, this study uses a combination of treatments to down-regulate hTERT transcription, including an estrogen receptor ER a ligand, raloxifene, to block estrogen binding and prevent estrogen disruption of the TGF-b pathway. For a treatment to suppress the Akt pathway, either genistein or PX-866 is used.

**Life Sciences —Exhibit 12**

**Pauleatha Diggs**
University of Alabama at Birmingham
Mentor: Erik D. Roberson, M.D., PhD
Coauthor(s): Nick Cochran

## Pseudophosphorylation of tau at MARK sites increases the tau-fyn interaction

Tau is a microtubule associated protein typically found in neuronal axons. In Alzheimer's disease (AD), tau mislocalizes to dendrites. Furthermore, tau has been shown to interact with and facilitate aberrant AD-associated function ofFyn, a member of the Src family of tyrosine protein kinases, in models of AD. Mislocalized tau is characterized by hyperphosphorylation at particular sites. We asked if mimicking post-translational AD-related modifications of tau seen in the dendrites affects the strength of the tau-fyn interaction. The tau-fyn interaction was measured in vitro using an AlphaScreen® assay and in live cells using a Bioluminescence Resonance Energy Transfer (BRET) assay. The tau-fyn interaction was increased by pseudophosphorylation at four sites in the microtubule-binding domains that are phosphorylated by microtubule affinity-regulating kinase (MARK). Because phosphorylation by MARK is associated with dendritic mislocalization, our data indicate that mislocalized tau in dendrites may have increased affinity for fyn and suggest that the tau-fyn interaction may be an important target in AD pathogenesis.

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**Life Sciences —Exhibit 13**

**Amber Dixon**
University of Alabama at Birmingham
Minority Health Research Center—Summer Enrichment Program
Mentor: Rod Fullard, OD

## Optimizing 1D SDS-PAGE tear cytokine isolation for mass spectrometry

More than 40 percent of Americans experience dry eye symptoms, making this one of the leading causes for visits to an eyecare professional. Aqueous tear deficiency, failure of lacrimal glands to produce sufficient tear fluid, has been linked to ocular surface inflammation. Current clinical tests are of limited diagnostic value due to the varying causes of dry eye. An accurate profile of ocular surface inflammatory biomarkers would help us better understand the cause in each case and may lead to more personalized treatments. Antibody-based assays show increased levels of certain tear cytokines in aqueous deficient patients compared to normal. However, these results are questionable because of potential assay artifacts. Mass spectrometry is the gold standard for quantitatively verifying the identity of biomarkers in samples such as tears. Gel electrophoresis (SDS-PAGE) is often used to help isolate biomarkers of interest from complex samples. For low abundance cytokines, larger samples are required and electrophoretic separation must be optimal.
To optimize tear volume and slab gel dimensions, tear samples, biomarker standards and molecular weight standards were separated on 24x24 cm SDS-PAGE gels. Tears were obtained from 5 normal and 5 patients with varying severity of aqueous-deficient dry eye. Results provided information on the quality of protein separation when using a gel of this size. Greater separation of the proteins would allow for more precise excision and larger gels allow more samples to be loaded. These factors increase the quantity and quality of proteins for mass spectrometry analysis.

**Life Sciences —Exhibit 14**

**Alison Johnston**
Miles College
Minority Health Research Center—Summer Enrichment Program
Mentor: C. Scott Bickel, PT, PhD

## Muscle Fatigue is Not Altered with Training in Older Women Using Electrically Induced- or Maximum Voluntary Contractions

As people age their muscles typically weaken and they become tired easily. Skeletal muscle fatigue is poorly understood and under-appreciated in aging women. Therefore, exercise regimes are not optimized to maximize both muscle and physical performance in the ever expanding aging population.

PURPOSE: To determine if combined resistance and aerobic training influences skeletal muscle fatigue in older women.
METHODS: Participants were 23 women who participated in a 16-week exercise training program consisting of both aerobic and resistance training. Each participant performed a series of maximum voluntary isometric contractions (MVIC) of both quadriceps. Central activation ratios (CAR) were calculated using the burst superimposition technique during MVIC. Fatigue protocols consisted of voluntary- and NMES-induced contractions. The voluntary fatigue protocol was a series of MVICs, each contraction was 5 seconds in duration with 5 seconds rest between contractions for 5 minutes (30 total contractions). The NMES-induced fatigue protocol (50 Hz, 450μsec biphasic pulses) was conducted on the other leg, 5 seconds on and 5 seconds off for 5 minutes (30 total contractions).
RESULTS: Sixteen weeks of combined resistance and aerobic training lead to significant improvements in muscle strength, cardiovascular fitness, and functional tasks. However, there were no significant differences in voluntary- or NMES- induced muscle fatigue protocols after training.
CONCLUSIONS: A combined resistance and aerobic training protocol did not significantly impact our measures of muscle fatigue. Further testing of other exercise protocols is warranted and additional measures of muscle fatigue may be indicated.
CONCLUSIONS: A combined resistance and aerobic training protocol did not significantly impact our measures of muscle fatigue. Further testing of other exercise protocols is warranted and additional measures of muscle fatigue may be indicated.

**Life Sciences —Exhibit 15**

**Erin Feeney**
Oakland University
Summer in Biomedical Sciences (SIBS)
Mentor(s): Chris Willey, M.D., Ph.D.
Coauthor(s): Tim Rohrbach, B.S., Josh Anderson, Ph.D., John S. Jarboe, Ph.D., Patricia H. Hicks, B.S.

## MARCKS as a Promoter of Cellular Senescence in Glioblastoma

Glioblastoma Multiforme (GBM) is the most common and deadly primary brain cancer with a median survival of 14 months, necessitating improved understanding of GBM biology. Our lab has shown that Myristoylated Alanine Rich C-Kinase Substrate (MARCKS) protein can regulate signaling pathways important in GBM. When MARCKS levels are low, GBM's grow rapidly and resist radiation treatment through enhanced DNA repair. However, overexpression of MARCKS reduces GBM growth and promotes "senescence," a state of dormancy. Therefore, we sought to explore the mechanism for MARCKS-induced senescence. Because senescent cells do not divide, we generated doxycycline-inducible V5-tagged MARCKS overexpressing GBM cell lines (U87 and U251). Stimulation of these stable lines with 1 uM doxycycline for 16h yielded several fold induction of MARCKS. Next, we measured the capacity of these cell lines to enter senescence using a β-galactosidase stain (SABG, enzymatic marker for senescence) and a fluorescin di-beta-d-galactopyranoside (FDG, another marker of senescence) assay. We found that doxycycline-induced MARCKS promoted senescence in U87 but not U251 cells as evidenced by increased SABG staining and FDG intensity only in doxy-induced U87 MARCKS overexpressors. Two additional lines of investigation are ongoing. First, doxy-inducible domain-specific MARCKS mutant overexpressors have been isolated in U87 and U251 cells and are being tested for senescence inducibility. Furthermore, we are using a co-immunoprecipitation approach to determine whether MARCKS is acetylated in GBM as this could also impact senescence. In summary, we show that MARCKS can promote senescence in GBM cells and ongoing studies will elucidate the key MARCKS domain(s) mediating this phenomena.

**Life Sciences —Exhibit 16**

**Joshua Godwin**
University of Alabama at Birmingham
Mentor(s): Dr. Nicole Riddle

## Analysis of Expression by Genes that Bind HP1B in D. melanogaster

The purpose of this project is to investigate if expression levels of genes binding HP1B protein in mutant Drosophila larvae are lower than expression levels in wild type larvae. Position effect variegation (PEV) studies, by means of utilizing an hsp70-white reporter, mutations in HP1b act as Enhancers of variegation [E(var)], leading to increased silencing at the reporter. HP1B has been found to associate with transcription start sites. These findings imply that the wildtype function of HP1b is that of a transcriptional activator. Thus, we hypothesize that in wild type, genes bound by HP1B protein will have higher levels of RNA compared to HP1b mutants. We will examine a set of genes that associate with HP1B using quantitative PCR; a set of genes that do not associate with any of the HP1 family proteins will serve as the negative control. To date, PCR conditions for all primer sets have been optimized. We have isolated RNA from larvae of both wild type and mutant Drosophila strains (HP1b 16 & HP1b 86), and performed quality control experiments. This extracted RNA will then be used in a reverse transcriptase reaction (RT) to synthesize cDNA. Experiments are ongoing, and results will be reported.

**Life Sciences —Exhibit 17**

**Stacey Harrison**
Cornell College
Summer in Biomedical Sciences (SIBS)
Mentor(s): Sunnie R. Thompson, Ph.D.
Coauthor(s): Beth Walters

Investigating alternative mechanisms of translation initiation induced by flaviviral infection

Cap-dependent translation initiation requires 10-13 initiation factors and the mRNA molecule's 5' cap. However, some viruses subvert host ribosomes by inhibiting cap-dependent translation and using an alternate mechanism for initiation. The exact mechanism of translation initiation is unknown for yellow fever (YFV) virus. Although previously assumed to use cap-dependent translation due to its 5' cap, studies have suggested that YFV translation is cap-independent. We have identified a ribosomal protein S25 (RPS25) required for alternate mechanisms of translation initiation, but which has no effect on cap-dependent translation. Knockdown of RPS25 during YFV infection inhibits viral replication, implicating an alternate mechanism of initiation, such as ribosomal shunting. In ribosomal shunting, the small subunit is recruited to mRNA through a cap-dependent process and shunted downstream to an accepter site near the AUG start codon, bypassing regions of the mRNA without scanning. To assess whether YFV induces a cellular environment conducive to ribosomal shunting, translational reporters will be employed

**Life Sciences —Exhibit 18**

**Melissa Johnson**
Hood College
Crime Research Experience for Undergraduates (REU)
Mentor(s): Dr. Beth Gardner
Coauthor(s): Andrew Eaton, UAB

Characterization of Volatile Organic Compounds from Bovine Decomposition

The detection of volatile organic compounds (VOCs) characteristic of decomposition is used in the identification of clandestine burial sites. Human, deer, pig, and dog decomposition have been studied. Over 470 VOCs have been identified and about 30 of these compounds are specific to human decomposition. However, the VOCs from bovine decomposition have not been investigated. The objective of this project is to study the VOCs of bovine decomposition produced under the anaerobic conditions in the absence of gut bacteria.

Composite samples of bovine muscle, liver, and marrow were prepared in triplicate and stored in sealed glass vials. The gasses in the headspace of each vial were sampled on a weekly basis and analyzed with gas chromatography-mass spectrometry (GC-MS). Significant peaks and compounds found in the spectra of each beef sample were recorded each week. Sixteen different compounds were detected over the course of seven weeks. Characterization of the compounds is in progress.

**Life Sciences —Exhibit 19**

**Claudia Martinez-Lopez**
Florida International University
Physics Research Experience for Undergraduates (REU)
Mentor(s): Dr. Eugenia Kharlampieva, Dr. Veronika Kozlovskaya
Graduate student collaborator: Fei Liu

Study of the stability and permeability properties of tannic acid and poly(vinylpyrrolidone) layer-by-layer systems as well as drug release properties of the ultrathin multilayer capsules.

Interest in tannic acid (TA) has spiked recently due to its high biological activity including antioxidant, anticarcinogenic, and antibacterial properties. UV-Vis Spectroscopy was performed to measure the stability of TA in solution at different pH; the results showed that, for pH values lower than 7.6, tannic acid was relatively stable, and for pH higher than 7.6, the signal shifted to longer wavelengths, probably reflecting ionization and some oxidation. Our experiments demonstrated that, when working with tannic acid, fresh solutions have to be prepared after six hours in order to obtain more accurate results. Rectangular silica wafers were used as substrate for the deposition of an ultrathin film using hydrogen-bonded TA and poly(N-vinylpyrrolidone) (PVPON). The deposition of TA and PVPON layers was performed at various pH, and their final thickness in nanometers was recorded using Spectroscopic Ellipsometry. As the deposition pH increased, the thickness of the bi-layer system decreased. After characterizing the pH-dependent behavior of TA/PVPON bi-layer films, ultrathin multilayer capsules on sacrificial particulate templates (cores) were created. After the successful creation of dipolymer capsules, the drug Doxorubicin, an important cancer chemotherapeutic, was then loaded in 8 bi-layer TA/PVPON capsules and the release properties were measured at different pH using UV-Vis Spectroscopy. The drug release was monitored over time at pH 5, 6, and 7. Doxorubicin absorbance in the spectrum was higher at pH 5 than at pH 7, which means that the drug released on higher amounts at lower pH values.

**Life Sciences —Exhibit 20**

**Luis Mestre**
Universidad Metropolitana
Summer in Biomedical Sciences (SIBS)
Mentor(s): Michael Sandel, Hermant Tiwari, Curtis Holliman

The Evolution of Mitochondrial tRNAs in Spiny Ray-Finned Fishes

The spiny ray-finned fishes (Teleostei: Acanthomorpha) account for one quarter of all known vertebrate species, including 90% of the fishes in the world's oceans. Acanthomorphs have adapted to nearly every aquatic environment on the planet, from marine hydrothermal vents at -4,000 m, to freshwater Lake Titicaca at nearly +4,000 m. In accordance, species have evolved an extraordinary diversity of physiological specializations that are essential for cellular maintenance and proliferation. We aim to identify key mutations in the mitochondrial tRNAs of Acanthomorph fishes, which are hypothesized to play a key role in the maintenance of protein synthesis and energy balance.

We assembled a database containing 22 mitochondrial tRNAs from 160 species representing 77 acanthomorph families. We inferred the phylogenetic gene tree for each tRNA sequence using a Maximum Likelihood algorithm employed by RaXML. Analyses were conducted on the XSEDE supercomputer hosted by UCSC. We compared topologies inferred from each tRNA with well-resolved trees inferred from protein-coding genes, in order to identify non-phylogenetic signal in the tRNA sequence data.
We identified phylogenetic discordance in the tRNA topologies that could reflect selection for structural variants with functional consequences. We interpreted discordant results in the context of ecological differences among species, and proposed general models to explain putative functional consequences of tRNA variation in different cellular environments.
Mitochondrial tRNA mutations have been associated with many diseases among humans. Ultimately, we will examine homologs of each disease-associated SNP in the acanthomorph phylogeny, which could identify novel model organisms for the study of specific diseases.

**Life Sciences —Exhibit 21**

**Hayley Moon**
Auburn University at Montgomery
Physics Research Experience for Undergraduates (REU)
Mentor(s): Dr. LuFang Zhou

## Creation of Adenovirus from Plasmid DNA Construct

Optogenetics is an expanding field that involves using light to control organism function on a cellular level. Since its inception in 2002, optogenetics has primarily been used in neuroscience to study brain activity and neural function. The aim of this research was to create a plasmid DNA construct that will be used in the creation of an adenoviral stock. The plasmid DNA construct will express the opsin Channelrhodopsin 2, a non-selective light sensitive protein channel that was discovered in the algaeChlamydomonas reinhardtii. Channelrhodopsin 2 can be activated by shinning blue light, 470nm wavelength range, on the protein channel causing the channel to open. The plasmid DNA was generated using two different E. coli cultures in LB medium. The plasmid DNA was then purified using buffers provided in the QIAprep Spin Miniprep Kit. After purification, the plasmid DNA was assessed for purity using NanoDrop instrumentation and software. The future plan after the creation and purification of the plasmid DNA is to combine the plasmid DNA with PAD/PL-DEST in a LR reaction. After the reaction, the plasmid DNA will be digested using Pac I exposing the inverted terminal regions (ITRs) and ridding the construct of any bacterial sequences. The digested plasmid will then be transfected into a 293A cell line creating an adenoviral stock. The titer of the adenoviral stock will be determined. The viral supernatant will then be ready to be added to the desired mammalian cell line of interest—cardiac cells.

**Life Sciences —Exhibit 22**

**Valentine Nwachukwu**
University of Alabama at Birmingham
Summer in Biomedical Sciences (SIBS)
Mentor(s): Inga Kadisha, Ph.D.
Coauthor(s): Alana Brock, Thomas van Groen, Ph.D.

## Small peptides as treatments for Alzheimer's disease

Currently there are no treatments for Alzheimer's disease (AD), a progressive neurodegenerative disorder, thus the development of novel treatments for this disease is imperative. The imbalance between Aβ production and breakdown/clearance leads to the subsequent accumulation of Aβ, a proteolytic fragment of the amyloid precursor protein (APP). Likely Aβ plaques do not significantly contribute to the cognitive deficits of AD, but there is strong evidence that Aβ oligomers cause the development of cognitive deficits. Therefore, peptides that would interfere with the oligomerization of Aβ could be used as a treatment for AD. Previously we have shown that treatment with D3 and D3-D3 peptides improved memory deficits and pathology in young adult mice. In this study we examined whether treatment with new peptides that bind strongly to the soluble Aβ oligomers would ameliorate the AD like pathology and improve the cognitive deficits in aged AD model mice.

**Life Sciences —Exhibit 23**

**Katherine Owens**
The University of Alabama at Birmingham
Mentor(s): Nicole C. Riddle

## Characterization of Novel D. Melanogaster Stocks Containing a GFP-EGG Transgene

Green fluroescent protein (GFP) is a reporter frequently used in molecular and cell biology. To examine protein levels and localization, GFP is fused to a protein of interest, and GFP is monitored instead of the protein of interest. In Drosophila melanogaster, the eggless (egg) gene encodes a protein with histone methyltransferase activity that is involved in the regulation of gene expression and a variety of other biological processes. We have obtained four uncharacterized fly stocks from Kevin White's laboratory, which potentially contain a transgenic copy of egg fused to GFP. The goal of this work is to characterize these novel fly stocks. Initial characterization focuses on confirming the integrity of the transgene. We have confirmed that the ΦC31 integrase, which was used to mediate the insertion of the transgene into the genome, is no longer present. Using PCR and gel electrophoresis we have also confirmed that the transgene insertion site used (attP) is no longer present in our fly stocks. We are currently using PCR and gel electrophoresis to determine if two new junction fragments (attR and attL) appear at the insertion sites as expected if integration occurred. The same strategy is being used to confirm if the GFP tag is properly fused to the egg gene. GFP will be examined by fluorescent microscopy. Finally, we will test if the GFP-EGG transgene is properly functioning by performing a rescue experiment. If successful, these fly lines will provide an extremely valuable resource for our studies of the EGG protein.

**Life Sciences —Exhibit 24**

**Louis Porreca**
University of Scranton
Summer in Biomedical Sciences (SIBS)
Mentor(s): Kevin Roth, M.D., Ph.D.
Coauthor(s): Christopher Graham

## The Combinatorial Effects of AT-101, Tamoxifen, and Temozolomide on Glioblastoma Multiforme

Glioblastoma multiforme (GBM) is the most common and aggressive primary malignant brain tumor. Its invasive nature causes it to be intractable to complete surgical resection, and its resistance to the current chemotherapeutic standard, the apoptosis-inducing temozolomide (TMZ), further contributes to the difficulty of GBM treatment and its low survival time of 12-14 months. Tamoxifen (TMX) and AT-101 are two drugs known to lower the apoptotic threshold through reduction of cellular pro-survival components. Through the use of a human malignant GBM cell line, U87MG, we analyzed whether combination treatment with TMZ and TMX and/or AT-101 is a more effective treatment than TMZ alone. AT-101 sufficiently lowered the apoptotic threshold, resulting in an additive effect with TMZ. The effects of TMX with AT-101 and/or TMZ require further analysis and study. Further research should be pursued to confirm these developments.

**Life Sciences —Exhibit 25**

**Matthew Ratti**
Rutgers University - Camden
Summer in Biomedical Sciences (SIBS)
Mentor(s): Tom Ryan, Ph.D.
Coauthor(s): Jonathan Lockhart

## Effects of Diprotin A and Anti-CD122 on Bone Marrow Engraftment Efficiency in Humanized Cooley's Anemia Mice in the Absence of Cyto-Reductive Conditioning

Beta-thalassemia major, also known as Cooley's anemia (CA), is the most severe form of the blood disorders know as beta-thalassemia. Patients with CA have mutations in both adult beta-globin genes and are unable to make functional adult hemoglobin (a2b2) in their erythroid cells. The current cure for CA is allogeneic bone marrow transplantation (BMT). However, there are many risks involved with a BMT procedure, such as potentially lethal myeloablative conditioning, graft rejection, and graft versus host disease. We have developed a novel BMT methodology that avoids lethal conditioning regimens using a preclinical humanized mouse model of CA. In this method, humanized CA mice receive no cyto-reductive conditioning. Newborn CA pups are injected with anti-CD122 antibody to suppress their endogenous immune system before transplanting allogeneic donor bone marrow cells treated with Diprotin A to increase hematopoietic stem cell (HSC) engraftment. In this study the effects of the combined or individual anti-CD122 and Diprotin A treatments on engraftment efficiency in the absence of cyto-reductive conditioning are investigated. Donor bone marrow cell contribution to the hematopoietic system was measured at three weeks post-transplantation. We concluded that both Diprotin A and anti-CD122 are necessary for successful BMT in the absence of cyto-reductive conditioning.

**Life Sciences —Exhibit 26**

**Nathaniel Reeve**
University of Alabama at Birmingham , School of Medicine
Mentor(s): Corinne E. Griguer
Coauthor(s): Tara Markert, Claudia Oliva

## Cytochrome c oxidase in malignant glioma

Temozolomide (TMZ) is an oral alkylating agent used for the treatment of high-grade gliomas. Acquired chemoresistance is a severe limitation to this therapy with more than 90% of recurrent gliomas showing no response to a second cycle of chemotherapy. Efforts to better understand the underlying mechanisms of acquired chemoresistance to TMZ and potential strategies to overcome chemoresistance are, therefore, critically needed. TMZ methylates nuclear DNA and induces cell death; however, the impact on mitochondrial DNA (mtDNA) and mitochondrial bioenergetics is not known. Herein, we tested the hypothesis that TMZ-mediated alterations in mtDNA and respiratory function contribute to TMZ-dependent acquired chemoresistance. Overall our results suggest that acquired chemoresistance may be due to a mitochondrial adaptive response to TMZ genotoxic stress with a major contribution from cytochrome c oxidase (1-3).Thus, abrogation of this adaptive response may reverse chemoresistance and restore sensitivity to TMZ, providing a strategy for improved therapeutic outcomes in GBM patients.

**Life Sciences —Exhibit 27**

**Alexa Sughroue**
Beloit College
Summer in Biomedical Sciences (SIBS)
Mentor(s): Doug Hurst, Ph.D.
Coauthor(s): Monica J. Lewis

## Regulation of breast cancer metastasis by SIN3A

In 2013, it is estimated that about 14% of female deaths in the United States will be due to breast cancer, with the majority of those cases caused by the complications arising from metastases. Metastasis is a complex multi-step process that requires the expression of specific genes to allow a tumor cell to appropriately respond to a changing environment. Many genes associated with metastasis are regulated epigenetically by chromatin remodeling complexes that modify histone proteins through the recruitment of protein modifying enzymes. SIN3A (SWI-Independent 3A) is a scaffolding protein that recruits histone deacetylases (HDACs) to function at particular sites of the genome, typically leading to transcriptional silencing. Although SIN3A is not well characterized, it has been demonstrated to function in vital cell activities, including growth and proliferation, embryonic development, differentiation, etc. We hypothesized that expression of SIN3A was important for the metastasis of breast cancer cells. To begin to investigate this hypothesis, we generated cells with decreased SIN3A expression using shRNA in metastatic breast cancer cells. Cell proliferation, as measured with an Alamar blue assay, was not significantly altered; however, we noted changes in the migratory phenotype using several migration and invasion assays. These results suggest important roles for SIN3A in the ability of breast cancer cells to metastasize that may lead to the identification of new targets for the treatment of this devastating disease.

**Life Sciences —Exhibit 28**

**Chealsea Tuttle**
Quinnipiac University
Crime Research Experience for Undergraduates (REU)
Mentor(s): Dr. Beth Gardner

## A One-Step Enhanced Cyanoacrylate Fuming Method for Fingerprint Development

Latent fingerprints can consist of sweat and oils from both the eccrine and sebaceous glands. The cyanoacrylate fuming method (CFM) is a commonly used method to develop these fingerprints on non-porous surfaces. The method involves exposing the fingerprints to cyanoacrylate (superglue) fumes in a closed chamber. The fumes polymerize on the fingerprint ridges. As prints age the cyanoacrylate polymerization reaction is less active. A current area of fingerprint research is the pre-treatment of prints with acetic acid or ammonia fumes before CFM. In this project eccrine and sebaceous prints will be developed using a one-step process instead of the two-step pre-treatment process. The ammonia or acetic acid is placed inside the tank, replacing the water that is used in the CFM method to ensure a humid environment for the fuming. The superglue fumes as well as the acid or base fumes will interact with the prints simultaneously. Early results indicate that the one-step ammonia method does enhance sebaceous prints. Prints aged in increments from 1 day – 14 days will be developed using the one-step ammonia method. During each trial, three prints will be developed without base, with 2.92% ammonia solution, and with 29.2% ammonia solution. The best method will be determined by the quantity of minutiae present after treatment.

**Life Sciences —Exhibit 29**

**Mary Morgan Weed**
University of Alabama at Birmingham
Mentor(s): Dr. Anil Challa, Dr. Bob Kesterson

Generation of mutant alleles of Mc4r using the TALEN technology

Obesity is a complex disease with both genetic and environmental factors contributing to the epidemic. About 5% of morbidly obese patients harbor a mutation in their melanocortin-4-receptor (Mc4r) gene with a single mutant allele sufficient to cause disease. In order to further study this genetically linked form of obesity, I aimed to make new mice and zebrafish models. The mouse and human genome are extremely similar and are almost identical for the Mc4r gene. Although the zebrafish genome is not as similar to humans as mice, they offer several experimental advantages. In order to create an Mc4r mutation in these animal models, I used TALEN technology. A Transcription Activator-Like Effector Nuclease (TALEN) is a customized fusion protein with a DNA binding domain attached to a FokI nuclease. A pair of TALENs is required to effectively cut a DNA sequence to make a double stranded break, thereby creating a mutation. The pair of TALENs recognizes a specific sequence in the DNA, binds to either side of the spacer sequence, and when the two FokI domains come in proximity, they make a double stranded break in the spacer sequence. I have constructed unique pairs of TALENs to mutate the Mc4r gene in mice and a separate pair for zebrafish. RNA injections are soon to follow. I have also started making TALENs to cut out the entire Mc4r exon in mice and zebrafish, with an aim to replace the endogenous sequence with human cDNA/exon by way of a repair template.

**Life Sciences —Exhibit 30**

**Darricka Green**
Alabama State University
Minority Health Research Center—Summer Enrichment Program
Mentor(s): Brian Sims, MD, PhD

BIOLOGY OF EXOSOMES: Clinical Implications for Neural Stem Cell Repair

Exosomes are small (30-100 nm) membrane vesicles formed inside multivesicular endosomes and released upon the combining of the endosomes and plasma membrane. They are secreted by most cell types and present in biological fluids such as urine, blood and cell culture. They also have specific ligands and receptors on the surface that target specific cell types bearing the right counterligands. The single function of each of the exosomes depend on the cell types from which they are secreted. Exosomes have many roles including transfer of pathogenic proteins, waste management, tissue repair, and neural communication. The neural communication function of these vesicles has been the leading focus behind recent studies on exosomes, due to their ability to interact with neighboring cells. Exosomes may have a major role in mediating intercellular signaling. Also, exosomes may also facilitate the delivery of various bioactive materials to their surrounding cells (Fruhbeis et al.,2012)including proteins, lipids and microRNA. In our laboratory there are some studies underway to examine the potential clinical implications of proteins derived from exosomes. Other labs have shown data that focused on the potential of dendritic cell-derived exosomes as cell-free cancer vaccines (Chaput et al.,2006) and in another study exosomes were used in the setting of murine experimental autoimmune encephalomyelitis (EAE) in pregnancy (Williams et al.,2013).These studies are innovative and may lead to a groundbreaking discovery in the near future. Our current hypothesis is that exosomes are neuroprotective in vitro which may afford the same protection in vivo.

**Andrew Nunn**
Stillman College
Minority Health Research Center—Summer Enrichment Program
Mentor(s): Marla Hertz, PhD
Coauthor(s): Marla Hertz1, Mary-Ann Bjornsti1

# Exploring the relationship between Cdt1 and Sirtuins/Sir proteins in response to DNA damage

Cancer is a deadly disease caused by uncontrolled replication of mutated cells. Because no one drug is 100% curative, medicine combinations are often used clinically. The drug Camptothecin targets DNA Topoisomerase 1 in the S-phase of the cell cycle and causes cell death by a poorly understood mechanism. To learn more about Camptothecin-induced cell death, we used a Camptothecin-hypersensitive mutant yeast strain encoding a mutant CDT1 gene, cdt1G233E. CDT1 is an essential protein that assures that DNA is replicated only once during the cell cycle. Cells that express Cdt1G233E exhibit a dumbbell phenotype at 36°C. The deletion of the histone deacetylase SIR2 has been shown to suppress the effects of the cdt1G233E mutation. Histone deacetylases remove acetyl groups from histone tails, stabilizing DNA/histone interactions and subsequently inhibiting transcription. Sir2 has many roles in the cell, some of which rely on other Sir proteins. Therefore, we asked if deleting other SIR genes such as, sir3Δ and sir4Δ have the same rescuing effect in the cdt1G233E mutant. We tested the viability of cells with cdt1G233E in combination with sir2Δ, sir3Δ, and sir4Δ to see if the double mutant restored viability at 36°C. We also looked at the double mutants to see if they still exhibited a dumbbell phenotype. sir4Δ and sir3Δ suppress the phenotype as seen in sir2Δ, which suggests that SIR2 relies on SIR3 and Sir4 in its genetic interaction with CDT1. Because, the CDT1 and SIR genes are conserved in humans, this information could provide a better understanding of current and future drug combinations for cancer treatments.

**Physical Science and Engineering —Exhibit 31**

**Phillip Allman**
University of Alabama Birmingham
Physics Research Experiences for Undergraduates (REU)
Mentor: Dr. Renato Camata, Dr. Ryoichi Kawai

## Implementation and Calibration of an Optical Trapping System for the Study of Complex Fluids

A dielectric micro-particle suspended in a fluid and placed in the focused beam of a laser, experiences forces due to its collisions with the molecules of the fluid and the transfer of momentum from the incident photons. The dynamics of this microscopic system can be modeled as the motion of a Brownian particle in a harmonic potential. Careful analysis of the frequency-dependent behavior of such a particle allows probing of its microenvironment and observation of important phenomena in thermodynamics, fluid dynamics, and statistical mechanics. Moreover, experiments with Brownian particles in complex fluids such as vesicle ensembles, cell suspensions, and DNA-nanoparticle conjugate colloids, provide excellent opportunity for exploring the rheological and mechanical properties of these important biological environments. In this work we describe how we have implemented a high-sensitivity optical trapping system that utilizes back focal plane detection and automated stage motion. Piezoelectric controllers allow position control and detection down to ~20 nm of micron sized dielectric spheres. We present the calibration procedure carried out to experimentally determine the force applied on the particle by the trapping laser beam and discuss how the theory of Brownian motion can be used to extract the viscous properties of the fluid surrounding the particle.

**Physical Science and Engineering —Exhibit 32**

**Jerome S. Arceneaux**
University of Alabama at Birmingham
Mentor: Dr. Jacqueline A. Nikles
Co-Author: Amanda L. Glover, Lindsey N. Cobb, Jesse A. Gettinger, David E. Nikles

## Isothermal Drug Release of Doxorubicin from Copolymer Micelles

We seek to build a thermally triggered, drug-delivery system for cancer chemotherapy, consisting of polymer micelles made from poly(ethylene glycol-b-caprolactone), a diblock copolymer (PEG-PCL) or poly(ethylene glycol-b-caprolactone-b-lactic acid), a triblock terpolymer (PEG-PCL-PLA), with the cancer drug trapped in the hydrophobic core of the micelles. The polycaprolactone in the micelle core is semicrystalline, and it is expected to trap the cancer drug, preventing its release until the core has melted, the basis for thermally triggered release. The loading capacity and isothermal release for dibucaine, a surrogate cancer drug, were determined for seven different polymers. Three of these polymers (MeO-PEG42-PCL19-H, MeO-PEG113-PCL99-H, and MeO-PEG108-PCL50-PLA46-H) were selected for further study using Doxorubicin, a true cancer drug. The triblock, MeO-PEG108-PCL50-PLA46-H, had an impressive Doxorubicin loading capacity of 16.5%. Isothermal release curves for Doxorubicin were measured in triplicate at 27°C, 37° C, 47°C, and 57°C.

**Physical Science & Engineering —Exhibit 33**

**Mathew Bailey**
University of Maryland Baltimore County
Physics Research Experiences for Undergraduates, (REU)
Mentor: Dr. Derrick Dean
Co-Author: Carrie Schindler

Optimization of piezoelectric PVDF films for electroactive strain measurements

Of the five crystalline phases that exist in poly(vinylidene fluoride) (PVDF), the ß phase is responsible for piezoelectric properties in the material. These properties are desirable for applications in aerospace, robotics, and medical devices. Five grades of PVDF were studied to determine a processing method that creates films maximizing the amount of ß crystalline phase while maintaining mechanical integrity: a general use homopolymer, a high molecular weight homopolymer, a composite with carbon fibers, a copolymer with hexafluoropropylene (HFP), and a copolymer with chlorotrifluoroethylene (CTFE). Films were prepared under two methods: in a heat press with varied pressure and cooling durations, and by solution casting with dimethyl formamide (DMF). To enhance electrical and physical properties, heat pressed films were stretched to draw ratios up to 2.5, and fluorine modified carbon nanotubes (CNT-F) were added to solution cast films of the PVDF/CTFE copolymer. Though solution cast films had higher fractions of ß crystallinity, heat pressed films had better mechanical integrity. Differential scanning calorimetry (DSC) scans showed that the copolymers had the lowest total crystallinity; however, Fourier transform infrared (FTIR) spectroscopy and X-ray diffraction (XRD) scans showed the most ß phase crystallinity. The optimized films were found by heat pressing the copolymers and letting them cool over four hours before stretching them to a draw ratio of 2.1 at ambient conditions. Piezoelectric responses of the films were measured with a modified thermomechanical analyzer (TMA) and with conductive atomic force microscopy (C-AFM).

**Physical Science & Engineering —Exhibit 34**

**Dan Cargill**
Hendrix College
Physics Research Experiences for Undergraduates (REU)
Mentor: Dr. Yogesh K. Vohra
Co-Author: Dr. Georgiy M Tsoi

High Pressure Low Temperature Resistance Measurements of CaFe2As2 Based Compounds

Superconductivity was originally discovered in 1911 but it was not until 1986, with the discovery of high temperature superconductors, that practical applications seemed possible. In 1986 Bednorz and Muller found that lanthanum -barium-copper-oxide was superconducting with a critical temperature of 30K, the highest which had been measured to date. Their discovery marked the first of a new class of high temperature copper-oxide based superconductors as well as prompting a surge of activity which lead to the discovery of superconducting behavior up to 159K in a copper-oxide based compound. Copper-Oxide based compounds, however, turned out to not be the only high temperature superconductors. In 2008, researchers at the Tokyo Institute of Technology found superconductivity at 26K in an iron based compound which has now lead to a family of iron based superconductors. One new member of the iron based family is CaFe2As2 doped with praseodymium. This was the compound we studied. We measured the electrical resistance of samples that were doped with 10 and 15 percent praseodymium under high pressure and down to 10K. We found that the possible superconducting transition is two phased and suppressed under high pressures. We also found the first phase to have a transition temperature as high as 50K. There is no agreed upon theory to explain high temperature superconductors so this data could aid in attempts to develop new physics as well as adding to what is already known about what kind of iron based compounds are superconducting.

**Physical Science & Engineering —Exhibit 35**

**Hafez Golzarian**
University of Alabama at Birmingham
Mentor: Sadanandan E. Velu, Aimee Landar
Co-Author: Bala Chandra Chenna

## Development of Novel Mitochondrially-Targeted Electrophilic Compounds as Potential Anti-Metastatic Drugs in Breast Cancer Cells

Breast cancer accounts for approximately 25% of all new cancer cases diagnosed among women annually and is the second leading cause of cancer-related death among women.If the diagnosis of breast cancer is made at early stages, the survival rate after 5 years is relatively high (between 83 and 98%). When breast cancer is diagnosed with metastasis, the survival falls to 23%.Up to 40% of all patients who are treated for localized breast cancer develop metastasis. Currently, there is no therapeutic strategy for metastasis prevention or targeting and current treatments rarely lead to long-term survival of patients without disease recurrence. Thus, there is an urgent need to develop drugs which inhibit metastatic properties, including cancer cell adhesion andmigration.The ability to prevent/reduce metastasis, a capability not yet realized, would represent a major breakthrough in breast cancer therapy and should dramatically improve life expectancies. Our laboratory has recentlyobserved that a mitochondrially-targeted electrophilic compound (iodobutyl triphenylphosphonium iodide; IBTP) inhibits cell adhesion,at concentrations which do not elicit overt cell death. Cell adhesion has been shown to bean important property required for successful cancer metastasis. The overall objective of this this project is to rationally modulate the key chemical features of IBTP in order to improve its anti-adhesion activity. We have conducted studies changing the linker length as well as the leaving group present in IBTP. Synthesis, characterization and biological evaluation of these IBTP analogs will be presented.

**Physical Science & Engineering —Exhibit 36**

**Ashlen Kurre**
University of Alabama at Birmingham
Physics Research Experiences for Undergraduates (REU)
Mentor: Derrick Dean, Vinoy Thomas
Co-Author: Roberus MacIntosh

## Synthesis and Characterization of Nanodiamond/Doxorubicin Loaded Electrospun PLGA and Cyclic RGD Functionalized Nanodiamonds for Sustained, Controlled, and Targeted Drug Delivery

The utilization of nanodiamonds in the field of drug delivery possesses many advantages. Among these advantages is that they can be used to deliver low dosages of drug over extended periods of time to reduce cytotoxicity in the body, they are cell membrane permeable, and the reduced chances of their being discarded through the body as waste. Nanodiamond-based systems can also be functionalized to target specific sites in the body, such as cancer cells, thus reducing toxicity at healthy sites and increasing the drug dosage at malignant sites. One of the main issues with chemotherapy is that it not only affects malignant cells, but it is also toxic to healthy cells and tissues as well. Because the drugs peak quickly in the body, they are eliminated fast, which results in one having to take large and multiple doses in order for them to be effective. However, because of the need for numerous dosages, the cancer may start to build up a resistance to the drugs, making them virtually ineffective. Our primary goal in this study is to develop a composite drug delivery system composed of electrospun PLGA [poly(lactic-co-glycolic acid)] polymer nanofibers and detonation nanodiamonds that give a controlled and sustained release of doxorubicin as a function of polymer degradation time and weight percent nanodiamond loading. This project will also consist of the synthesis and characterization of detonation nanodiamonds with cyclic arginine-glycine-aspartic acid (RGD) peptide, which will be used to selectively target the alphaVbeta3integrin that is over-expressed in tumor angiogenesis. This research has the potential to impact the way chemotherapy drugs are administered and to enhance the overall quality of localized cancer treatment.

**Physical Science & Engineering —Exhibit 37**

**Hillary Lam**
Johns Hopkins University
Physics Research Experiences for Undergraduates (REU)
Mentor: Dr. Vinoy Thomas
Co-Author: Dr. Vinoy Thomas

New Conductive Electrospun Scaffolds for Nerve Tissue Engineering

Neuronal regeneration has been aided by implanted scaffolds composed of both synthetic and natural polymers. Biomimetic scaffolds provide a sympathetic environment to nerve growth and guide the direction of repair while electrical pulses delivered to the scaffold have been shown to improve neuronal wound repair, by mimicking the signal transduction of native nerve tissue. In this study, electrically conductive melanin was co-electrospun with a poly(lactic-co-glycolic acid)-zein blend into both random and highly aligned fibrous scaffolds for the first time. The scaffolds were characterized for chemical, structural and mechanical properties by FT-IR, DSC, SEM and tensile testing methods. Mechanical evaluation showed that the Young's modulus increased with the incorporation of zein and melanin into a PLGA scaffold. The modulus also increased with the change in orientation from randomly aligned fibers to highly aligned fibers. SEM analysis reveals a fibrous morphology and shows the chances of beading increasing as the proportion of melanin changes from 5 wt% to 10 wt%. Cell-materials interaction studies are underway.

**Physical Science & Engineering —Exhibit 38**

**Joshua Plottel,**
Rensselaer Polytechnic Institute
Physics Research Experiences for Undergraduates (REU),
Mentor: Dr. Joseph G. Harrison

Dark Matter: Mystery of Orbital Velocities

Beginning with the seminal work of Fritz Zwicky [Zwicky, 1933], the existence of dark matter has been one of the accepted explanations for why orbiting objects in galaxy clusters do not obey the expected Newtonian fall-off with distance. There are a variety of possible identities of just what this dark matter is composed of, such as MACHOs [Griest 1991, 1993] and WIMPs [Griest 1993]. In this work, we explore the possibility that the dark matter is actually the relativistic mass associated with the gravitational potential energy (U) of these systems, i.e.: U/c^2. We acquired orbital velocity versus radius data for several galaxies and found that we could directly relate U to an integral that could be evaluated solely from that data. We were also able to extract, via fitting, the inertial masses for those systems from the same velocity data. Our calculated inertial masses were in reasonable agreement with published values. However, our relativistic masses were found to be 5 to 7 orders of magnitude smaller than the inertial masses we found. A few other issues need to be addressed before we can make a definitive conslusion and these will be presented and discussed.

**Physical Science & Engineering —Exhibit 39**

**Jamika Polk**
Jackson State University
Physics Research Experiences for Undergraduates (REU)
Mentor: Alan Eberhardt, PhD, Joseph Schwertz, MSBME
Co-Author: Shawn Gilbert, PhD

## A Pilot Study on Fracture Healing Using Hypoxia-Inducible Factors in Mouse Models of Diabetes

In the United States, approximately 25.8 million people (8.3% of the total population) suffer from diabetes. About 1 in every 400 is under the age of 20. Several studies have shown that diabetes is not only associated with an increased likelihood of bone fracture, but with diminished/reduced bone formation, premature resorption of cartilage, and reduced mechanical strength. However, the relationship between diabetes and fracture healing is unclear. Presently, 6-8 week old C57/BL6 mice, a common inbred strain used as models of human disease, were divided into three groups. Two groups were injected with an angiogenesis-promoting drug that affected the HIF (hypoxia-inducible factor) pathway. HIF is a transcriptional factor that regulates the adaptive responses of mammalian cells to low oxygen. The other group was injected with saline and served as a control. All of the mice underwent corticotomy and were allowed to heal for three weeks. The mice were killed using asphyxiation. Using previously established methods, a Bose Electroforce® TestBench actuator was used in conjunction with a rack-and-pinion gear system for torsional testing. In this blinded study, there were no apparent differences detected between the treatment groups. For further investigation into the role of the aforementioned treatments, the now broken bones were scanned using microCT. Providing visual representations of the fracture healing sites and numerous measures of trabecular bone, the scans may provide further insight into the effects of the treatments on bone healing.

**Physical Science & Engineering —Exhibit 40**

**Constance Previti**
Clemson University
Physics Research Experiences for Undergraduates (REU)
Mentor: Mary Ellen Zvanut

## Properties of Hydrogen Diffusion in Mg doped p-AlGaN

Understanding the properties of hydrogen when GaN semiconductors are doped with Mg is important for the development of light emitting diodes (LEDs). Other studies have shown that when Mg doped p-type GaN is put into contact with hydrogen at high temperatures the semiconductor becomes deactivated. Although this information is known about GaN, the properties in alloys of GaN are unknown. In order to develop a better understanding of p-type AlGaN and Mg activation, the goals of this experiment were to determine whether the hydrogen diffusion through p-type AlGaN occurs at the surface of the material and also if the activation of the Mg is directly related to the amount of aluminum present in the sample. The samples analyzed consisted of a 0.5 μm thick AlxGa1-xN film grown on a sapphire substrate with a 100Å thick p-GaN layer capping the film. Aluminum content ranged from 0% to 28%. The samples were annealed with 99.999% N2 gas at 4 different temperatures between 700°C and 900°C for 10-30min each time. After each anneal, electron paramagnetic resonance (EPR) spectroscopy signals of the activated Mg were measured. The experiment revealed that the limit of diffusion is not the surface barrier because Mg activation in the capped samples was similar to the behavior in uncapped samples. Results also showed that activation of p-AlGaN is directly related to the amount of aluminum present in the sample: when aluminum content was high, the amount of activation of Mg was low.

**Physical Science & Engineering —Exhibit 41**

**Jacob Quattrini**
St. John Fisher College
Physics Research Experiences for Undergraduates (REU)
Mentor: Dr. Shane A. Catledge

Effects of boriding on cobalt-chromium orthopedic implant alloy for improved adhesion of ultra-hard carbon films

The number of hip and knee arthroplasties is rising very quickly, causing patients to need safer and longer lasting joint implants. Metal-on-metal (MoM) implants have great potential because of their strength, low wear rate, and biocompatibility. The FDA has recently expressed concern with the safety of CoCrMo implants because wear particles cause cobalt and chromium ions to get released into the body which can result in metallosis and other health problems. We have attempted to boride CoCrMo to prevent elemental cobalt from residing on the surface where it would otherwise act as a catalyst for graphite formation during subsequent diamond growth using Chemical Vapor Deposition (CVD). We then grew a nanostructured diamond (NSD) coating on the surface to further improve the properties of the alloy. Microwave Plasma CVD was used for boriding and diamond growth. Characterization techniques that were used include: X-Ray Diffraction (XRD), X-Ray Photoelectron Spectroscopy (XPS), Atomic Force Microscopy (AFM), Raman Spectroscopy, nanoindentation, Rockwell indentation, and optical microscopy. Successful boride coatings were adhered and the most beneficial parameters were identified. Results showed that cobalt boride was formed at low power (i.e. low temperature), successfully eliminating elemental cobalt at the top surface of the substrate, and thereby minimizing its deleterious effects on diamond growth.

**Physical Science & Engineering —Exhibit 42**

**Matt Record**
Bates College
Physics Research Experiences for Undergraduates (REU)
Mentor: Dr. Uday Vaidya, Benjamin Geiger-Willis
Co-Author: Michael Scott Carpenter

Mechanical Characterization of Fiber-Metal Laminates Utilizing NRX Technology

Through combining the properties of different kinds of fibers, matrices, and metals together, fiber-metal laminates (FML) are stronger and more durable than any of their components alone. With many industries utilizing FMLs, research continues to improve the quality and decrease the production price of the composite material. Production of FMLs up to this point in time has usually included an adhesive, used to bond the composite to the metal laminates. The creators of the NRX technology characterized in this paper claim that their technology can bond fibers and metal using only mechanical bonds while still exhibiting similar properties to FMLs bonded with adhesives. Glass reinforced polypropylene laminates, under the trade name Polystrand, and Aluminum processed with NRX technology were the components of the FML used to test this claim. A modified flexure test based on ASTM D790 was done to obtain flexural stress-strain curves for the FML. ASTM D5528 GIC testing was performed to characterize how well the NRX Aluminum panels bonded with the Polystrand plates. Low velocity impact (LVI) testing was conducted to analyze how the FML absorbed energy of projectiles at low velocities. A series of ballistic testing was done using a single stage light gas gun in an attempt to determine the ballistic resistance of the material, as well as how the FML absorbed energy of projectiles at high velocities. While the results found in this study varied, enough positive results were shown to validate the further study of NRX materials in the production of FMLs.

**Physical Science & Engineering —Exhibit 43**

**Robert Reeves**
University of Tennessee at Martin
Physics Research Experiences for Undergraduates (REU)
Mentor: Dr. Yogesh Vohra
Co-Author: Dr. Gopi Samudrala

## Nanostructured Diamond Film Deposition on Silicon and Yttrium Aluminum Garnet Substrates

Nanostructured diamond possesses extraordinary properties in hardness, chemical resistance, and thermal conduction. The goal of this project was to determine a method to deposit a thin nanostructured diamond film on an yttrium aluminum garnet (YAG) crystal. Once a method is developed the industry would immediately enjoy greater thermal conductivity and possibly attain adhesive-free bonding of YAG crystals for high powered laser applications. Nanostructured diamond growth was attempted using microwave plasma chemical vapor deposition (MPCVD). A low pressure mixture of hydrogen, methane, and nitrogen are excited by a microwave emitter into a plasma ball located directly over the substrate. The thickness of the deposited film can be directly measured in situ by analyzing the fluctuations in apparent temperature recorded with a pyrometer due to the optical constructive and destructive interference during thin film growth. Initial tests were conducted on a silicon substrate in order to create a standard before attempting growth on YAG. This process has led to nanostructured diamond growth on the YAG substrate but challenges remain. Delamination of the diamond film from the YAG substrate occurs during cooling after initial deposition. This delamination is primarily result of a large difference between the thermal coefficients of expansion of YAG and diamond. Solutions to this problem may include developing techniques for low temperature diamond growth and/or adding an interface layer between the YAG substrate and the diamond film.

**Physical Science & Engineering —Exhibit 44**

**Phillip Isa Ritchey**
University of Alabama-Birmingham
Mentor: Dr. Curt E. Harper
Co-Author: Justin E. Sanders

## Most Prevalent Drugs in Death Cases: A Six-Year Study

The purpose of this research was to determine the most prevalent drugs in postmortem cases encountered by the Alabama Department of Forensic Sciences Toxicology Section. These data span a time period from 2007 – 2012. Each year was separated into two categories, “Homicide” and “Non-Homicide” postmortem cases. The total number of postmortem cases per category was determined and the number of instances of each drug in each category was determined. A list of the most prevalent drugs per category per year was compiled and the percentage of each drug per category per year was calculated. Cocaine was 56% more prevalent in homicide cases than in non-homicide cases. Methamphetamine was among the top five drugs in homicide cases. These drugs are both illicit drugs, and individuals who use these drugs are more likely to be in high risk, volatile environments, making them prone to violent behavior. Ethanol (drinking alcohol) was the most prevalent drug found in postmortem cases and was present in 28% of all cases over this span. Except for 2007,Hydrocodone(a prescription painkiller) was the second most prevalent drug in non-homicide deaths. This prevalence is consistent with the fact that Hydrocodone is the most prescribed medicine in the United States. The analysis of this data can be utilized to educate the public on emerging trends of drug abuse.

**Physical Science & Engineering —Exhibit 45**

**Terence Staples**
University of Alabama at Birmingham
Physics Research Experiences for Undergraduates (REU)
Mentor: Dr. Robert Mohr

## The Creation of Complex Organic Molecules in Stellar Mediums

Complex organic molecules can form in ices throughout the interstellar medium during to the process of UV photolysis. During this process, UV photons bombard an ice containing simple organic molecules, possibly breaking and creating new bonds. Matlab was used to simulate this process under specified conditions; however, simulating UV photolysis through programming presents its challenges. The challenge of decreasing computing time was approached by first modeling UV photolysis with a 3-dimensional cube consisting of O2using an absorption coefficient. After making justified assumptions, it was found that the simulation could produce the same results from a purely statistical standpoint, which decreased computing time. Still, there is the challenge of creating a program that can handle simple organic molecules that are harder to simulate because of the great volume of compounds that could potentially be formed.

**Physical Science & Engineering —Exhibit 46**

**Danielle Taylor**
Norfolk State University
Mentor: Dr. Veena Antony, Yasin Oduk

## Paclitaxel Loaded Nanoparticles for treatment of Malignant Mesothelioma

Malignant mesothelioma is an aggressive deadly pleural cancer disease that occurs as a result of prolonged inhalation of asbestos fibers. The pleural space is a target for malignant involvements in primary tumors of the pleura such as mesothelioma and in metastatic tumors. Its incidence is increasing worldwide, in part because of past exposure to asbestos. Health care and compensation costs for this disease in the US over the next several years are expected to reach $200B. In our military, exposure to asbestos occurred in shipyards and in exposure to insulating materials. The purpose of this research is to create nanoparticles loaded with an anticancer drug, paclitaxel to use with a thoracoscope which isan endoscope that is inserted through a puncture in the chest wall for the visual examination of the chest cavity. Poly (lactic-co-glycolic acid) (PLGA) 50:50 nanoparticles were prepared with double emulsion solvent evaporation method. Based off of the results, we successfully created uniform nanoparticles in nano-range with smooth spherical shape. High loading efficiency of paclitaxel to nanoparticles is achieved. For future works, we plan to optimize the size and cytotoxicity of paclitaxel loaded nanoparticles and proceed with in vivo experiments. This project will hopefully have the ability to detect early stages of malignant mesothelioma and kill it.

**Taneidra Walker**
University of Alabama at Birmingham
Physics Research Experiences for Undergraduates (REU)
Ho-Wook Jun, Adinarayana Andukuri, Patrick Hwang

# Effect of a Hybrid Biomimetic Nanomatrix on Cytokine Expression in U937 Monocytic Cells

Conventional cardiovascular therapies are restricted by the lack of re-endothelialization, restenosis, inflammation, and thrombosis. Previous works demonstrated as a solution the development of a hybrid nanomatrix that is designed to closely mimic the physical and the biochemical properties of the endothelial extracellular matrix. This hybrid nanomatrix consists of two components: A structural component comprising electrospun polycaprolactone (ePCL), and a bioactive component consisting of self-assembled nitric oxide (NO) releasing peptide amphiphiles (PA) This hybrid nanomatrix has been shown to promote endothelial cell proliferation, but limit smooth muscle cell proliferation and platelet adhesion. The goal of this study is to analyze the effects the hybrid nanomatrix on inflammation, by evaluating its effect oncytokine expression in U937 monocytic cells. This will be done by synthesizing two different PAs (PA-YIGSR and PA-KKKK), which contain endothelial cell-adhesive ligands and nitric oxide (NO) donors, and mixing them in a 9:1 ratio and reacting them with pure NO to develop PA-YK-NO. After PA-YK-NO self-assembles into a nanomatrix onto ePCL with craters formed by gas foaming and salt leaching, activated and unactivated human monocytic U937 cells will be seeded onto varying concentrations of PA-YK-NO and subsequent inflammatory cytokine expression will be analyzed using qRT-PCR. Results from these studies will provide information about the ability of this hybrid nanomatrix to prevent or reduce inflammation, and will further validate the feasibility of this hybrid nanomatrix as an alternative to conventional cardiovascular therapies.

**Public Health and Social & Behavioral Sciences —Exhibit 48**

**Cherelle Baliff**
Oakwood University
Minority Health Research Center—Summer Enrichment Program
Mentor: Joseph Schumacher, PhD

## The Effect of Lower-Extremity Constraint Induced Movement Therapy on Functional Activities in Children with Cerebral Palsy

Background/ Purpose: Constraint-Induced Movement Therapy (CIMT) is an efficacious treatment to improve upper and lower extremity function for adults with neurological impairments. Recently, there has been an interest in how CIMT can benefit young children with cerebral palsy (CP). The purpose of this study is to determine the effect of lower extremity (LE) CIMT on lower extremity function in CP children during daily activities.
Methods: The subjects were six ambulatory children with hemiplegic cerebral palsy (mean age = 6.2, SD +/- 1.3 years). Subjects received LE-CIMT (i.e. intense shaping exercises daily- 4 hours/day, 3 weeks). The primary outcome measure was the Lower Extremity-Pediatric Motor Activity Log (LE-PMAL), a structured interview where the parents rate the functional use of the child's more affected leg during daily activities. The rating scales included: 1) Assistance Scale 2) Functional Performance Scale and 3) Confidence Scale. The LE-PMAL was administered before, during, immediately after treatment, and one month later (follow-up). To determine differences between (pre, post, and follow-up) tests, we used the Friedman ANOVA statistic for non-parametric data and Wilcoxon Signed Rank post hoc tests. We also plotted each subject's results to determine individual response.
Results: The Friedman ANOVA was significant ($p=0.015$). The post hoc tests were significant for pre to post test ($p=0.03$), but not for post-test to follow-up ($p=0.41$). This indicated that subjects improved from pre-test and maintained gains at follow-up.
Conclusion: This study provides preliminary evidence that 3 weeks of LE-CIMT improves function for life situations in children with CP.

**Public Health and Social & Behavioral Sciences —Exhibit 49**

**LaCassidy Broadnax**
Miles College
McNair Scholars Program
Mentor: Joseph Schumacher, PhD

The family has a central role to play in the treatment of any health problem. Family work has become a strong and continuing theme of many treatment approaches, but family therapy is not used to its greatest capacity with homelessness, Dual Axis I diagnoses, and substance abuse treatment. A primary challenge remains the broadening of the substance abuse treatment focus from the individual to the family. The purpose of this study is to implement a family life area in Therapeutic Goal Management (TGM) for drug abstinence outcomes among homeless persons with Dual Axis I Diagnoses: The Birmingham EARTH Program. In this single case study, a staff member from The EARTH Program conduct assessments using TGM to set, monitor, and reinforce personalized goals to accommodate better relations with particular kindred. This information will likely impact the design of future substance abuse treatments with men who are homeless with Dual Axis I diagnoses.

**Public Health and Social & Behavioral Sciences —Exhibit 50**

**Lauren Cooper**
Tuskegee University
Minority Health Research Center—Summer Enrichment Program
Mentor: Michael Froelich

## Discovering the Disparities in Maternal Fatalities

Maternal mortality is defined as the death of women during pregnancy, childbirth, or in the 42 days after delivery. The worldwide maternal mortality rate (MMR) has decreased by almost 50% between 1990 and 2010. However, the MMR in the United States has risen from 12 deaths per 100,000 live births in 1980 to 17 deaths in 2008. Other studies have also shown that African American women are about four times more likely to experience maternal mortality. In order to work towards decreasing the MMR, doctors and scientists are trying to identify factors that may lead to maternal fatalities. This study investigated the effects of race, patient insurance, and other individual patient conditions on the MMR. Maternal fatality records were reviewed from patients who died at the University of Alabama at Birmingham (UAB) Hospital between 1999-2010. The results were analyzed to discover if there is a disparity in maternal deaths. The study did not show a significant difference in racial disparity at UAB Hospital. Also, no association was shown between age, body mass index, insurance status, marital status, or previous health indicators and the MMR at UAB Hospital. However, the research did show that the further away a high risk mother is from tertiary care, the higher the risk for maternal death. Some of the results are still being analyzed to see what factors affected the maternal mortality rate at UAB.

**Public Health and Social & Behavioral Sciences —Exhibit 51**

**Tobias Donnell**
Tuskegee University
Minority Health Research Center—Summer Enrichment Program
Mentor: Raegan Durant

Background

African Americans suffering from heart failure are hospitalized more frequently than white heart failure patients. Heart failure self-care consists of independent patient performed behaviors that can help reduce to hospitalization rates for heart failure. The objective of this study was to explore disparities in self-care behaviors among Whites and African Americans with heart failure.

Methods

Seven Hundred and Five White and African American heart failure patients who received care for heart failure at 3 hospitals completed a survey of self-care and other behaviors. The primary outcomes, self-care management and self-care maintenance, were measured by the Riegel Self-Care of Heart Failure Index. Race was the primary independent variable. Other variables included sociodemographics, phsychosocial factors and clinical factors. Multi-variable analysis was performed to identify the adjusted relationship between each independent variable and each dependant variable.

Results

The study population is 65% African American, 54% female, and 58% within the age group less than 65 years old. African Americans are less likely to be male (41% vs. 55% <.0001) or over 65 years of age (33% vs. 59% <.0001). Multivariable analysis adjusted for all covariates indicates that race is associated with low self-care Maintenance (OR 1.6, 95% CI 1.1-2.4). However, there is no indication of racial disparity among patients with low self-care management.

Conclusions

The study indicates that African-Americans with heart failure may be particularly vulnerable to low self-care maintenance compared to whites. Self-care educational efforts aimed at African Americans with heart failure should emphasize self-care maintenance to address this disparity.

**Public Health and Social & Behavioral Sciences —Exhibit 52**

**Gabrielle Goforth**
Tuskegee University
Minority Health Research Center—Summer Enrichment Program
Mentor: Brian Dudgeon, PhD

## Bodyweight Management Challenges Among Veterans with Spinal Injury or Disease (SCI/D)

Obesity has become a growing problem within the United States and its rate has more than doubled since the 1970s in both children and adults. Studies reveal that two-thirds of the adult population is overweight or obese. Within this population are disabled veterans with spinal cord injury or disease (SCI/D). People who have spinal cord dysfunction typically have impairments of mobility, and the ability to exercise and maintain physical activity is exceptionally difficult and usually limited. The excess amassment of adipose tissue in persons with SCI/D may contribute to poor functional performance, impaired mobility, prolonged hospitalizations and needs for special equipment. We sought to better understand attitudes regarding weight and techniques of weight management used by veterans with SCI/D by using a qualitative research approach. Twenty-one veterans (19 men and 2 women) with SCI/D engaged in a series of long interviews regarding their perceptions of weight gain and loss. Strategies that were used to manage weight and to maintain fitness and functioning were also discussed. All transcribed interviews were read carefully to identify topics and themes that emerged within and across participants. Research proved to be effective in discovering recurrent themes regarding weight status and management through diet, exercise, and other lifestyle changes.

**Public Health and Social & Behavioral Sciences —Exhibit 53**

**Wilnerys Colberg Hernandez**

Universidad Metropolitana
Mentor: José Fernández, PhD

Co-Authors: Kenneth p Kell, Michelle Bohan, PhD & Keith Pearson

## Interaction of Ancestral Genetic Background and Vitamin B12 intake with Adiposity in Children

Obesity is a complex disease that affects children and adults. Differences in obesity prevalence have been documented among racial/ethnic groups within the United States. These differences may respond to the interaction of micro-nutrients with individuals' ancestral genetic background (ADM). To evaluate if the interaction (INT) of dietary Vitamin B12 (B12) consumption and ADM influence levels of body fat among children from a multi-ethnic sample. B12 consumption was obtained from dietary recalls in a sample of 322 children from the Birmingham metropolitan area. Body fat was obtained through dual-energy X-ray absorptiometry, and ADM calculated from ancestral genetic markers. Multiple regression models were used to determine the contributions of INT to levels of body fat, after adjusting for relevant covariates. Levels of B12 did not differ among racial/ethnic groups. In a model evaluating the contributions of ADM, B12 and INT, B12 and INT significantly contributed to levels of body fat ($p=0.0015$ and $p=0.0059$, respectively). Individuals genetic background may interact with micro-nutrient consumption to impact levels of body fat, and may partially explain observed racial/ethnic differences in obesity-related measurements. Understanding how individual's ancestral background and nutrient consumption contributes to adiposity levels may be of importance when identifying pediatric obesity prevention strategies.

**Public Health and Social & Behavioral Sciences —Exhibit 54**

**Dayanara Lebron, Ana Vazquez , Emily Dhurandhar, Paulino Perez**
Universidad Metropolitana
Mentor(s): Ana Vazquez , Emily Dhurandhar, Paulino Perez

Genome Enabling Models for Type 2 Diabetes Risk Assessment

Type 2 Diabetes Mellitus (T2DM) is becoming one of the fastest growing chronic diseases in the United States. It is characterized by the resistance and deficiency of insulin production in the body. To date, clinical predictive models for this disease have only included phenotypic information as explanatory variables for risk susceptibility. Our objective is to include a large number of SNPs into multiple predictive models to improve prediction performance for T2DM risk assessment. Data was sampled from the Framingham Heart Study offspring and original cohort (n=5,245) which provided phenotypic and genotypic information for T2DM. We incorporated genotypic information into logistic regression (LR), in order to evaluate individual risk and SNP significance. Models prediction accuracy was compared by using the area under the receiver curve (AUC) estimated by a 10-fold cross validation. We computed the subjects genetic score (GS) by summing all risk alleles for T2DM on the susceptible locations. Two of the 21 SNPs found to be significantly associated to T2DM, where located on the GCKR and TCF7L2 genes, which work as regulatory proteins for blood glucose homeostasis. The computed incidence of diabetes for low and high risk, showed that 13.8% of cases had a GS lower than 66.32 and 23% higher than 72.75. When included in the LR prediction model, GS showed a high significant estimated p-value of 3.47e-16 and increased the predictive accuracy by 2%, in comparison to the baseline model, thereby improving prediction.

**Public Health and Social & Behavioral Sciences —Exhibit 55**

**Lydia Ring**
University of Alabama at Birmingham
Co-Authors: Caleb La Rue & Stephen Sheron
Mentor: Dr. Edwin W. Cook III

Effects of Meaningful Visual Looming Stimuli on the Human Startle Reflex

In the natural environment, rapidly looming stimuli frequently signal predation and/or collision. Despite the association with danger and threat, few studies of looming have used meaningful stimuli or validated measures of fear. In the present study, 39 undergraduates selected for high or low trait fear viewed unpleasant, neutral, and pleasant animals, objects and people isolated from their backgrounds and displayed on a random dot field. Each trial consisted of a 1-sec stimulus recognition period followed by a 1-sec period during which stimuli loomed, receded, or remained static in size. Participants pressed a button rapidly upon detection of looming or receding movement, and startle blinks were elicited during and shortly after the movement period. Looming compared to receding control stimuli were associated with smaller startle blinks, suggesting an adaptive attentional bias toward such stimuli. Unpleasant objects potentiated startles, and the effects of stimulus content and movement were generally independent. This finding, along with the differential effects of looming and unpleasant stimuli across measures, suggests that although both classes of stimuli may signal danger or threat, in this study they were processed by different mechanisms. Differential task relevance of movement and affective content may have played a significant role in this outcome.

**Public Health and Social & Behavioral Sciences —Exhibit 56**

**Emily Rose, McKenzie Acker, Sabrina Jackson**

University of Alabama at Birmingham
Minority Health and Health Disparities Research Center Summer Enrichment Program
Mentor: Angela Jukkala, Allison Todd

## Dissemination of APEC PEACE-P Guidelines through Smart Phone Technology

Women in Alabama continue to experience poor perinatal health outcomes. Further, obstetric providers are often disadvantaged in their ability to access evidence-based perinatal guidelines. To meet this need, the APEC PEACE-P (Alabama Perinatal Excellence Collaboration: Perinatal Education, Activation and Communication Enhancement) smart phone app was developed. An interprofessional collaboration (state/academic/practicing providers) was formed to guide the development and pilot testing of the PEACE-P smart phone app to disseminate APEC guidelines. To ensure the end product would be useful in practice, a provider advisory council was formed. A project time line was established, with an alpha and beta prototype. Focus groups with advisory council members were held throughout the development process to obtain feedback regarding acceptability and usability of the proposed app. Initial focus group feedback included: android/ iPhone/iPad compatibility; capacity to survey providers; "rate this app feature"; obtain internet domain; and inclusion of March of Dimes logo. During the second focus group following alpha testing, feedback included: easy access to guideline summaries and full narrative; standard font/color; categorized guidelines; install instructions; and end-user screen formatting. Third focus group recommendations included: consistent logo size; logos on home page only; and expansion of resources. The beta version was made available to focus group members, recommendations included: anonymous tracking; limit comment field; and add install instructions on APEC website. The APEC PEACE-P smart phone app facilitates evidenced-based practice at the "point of care". Evaluation of the impact of the app on perinatal outcomes will be examined through benchmark data collected by APEC.

**Public Health and Social & Behavioral Sciences —Exhibit 57**

**Alan Schumann, Ashleigh Tomkovich, Savannah Dewberry, Alexander Brookins**

University of Alabama at Birmingham
Mentor: Robert Sorge, Tammie Quinn

## Comprehensive Evaluation of the Efficacy of Common Analgesics for Spontaneous Pain Following Surgery

Introduction: Postoperative pain management is of high importance for researchers working with laboratory animals due to the ethical obligation to reduce pain whenever possible. However, very little is known about the efficacy of the analgesics used to treat spontaneous postsurgical pain, particularly in rats. It is unclear whether analgesic testing in acute pain tests accurately reflects the drug's ability to reduce spontaneous pain following surgery.
Methods: Wistar rats of both sexes were used in the experiments described. For the laparotomy experiments, before surgery, rats were placed in 4 Plexiglas cubicles and recorded for 30 minutes (as a baseline recording). On the test day, rats were given a laparotomy surgery followed by a single dose of analgesic (acetaminophen, buprenorphine, carprofen, ibuprofen, ketoprofen or their vehicles). After 1 hour, rats were recorded for 30 minutes. Representative images were taken from each recording and graded by blind observers using the Rat Grimace Scale. Difference scores were calculated (test day – baseline). For the hot plate test, rats were given a single dose of analgesic following baseline readings on a 53 °C hot plate. Tests were performed blind at 30 and 60 min post-injection.
Results: Buprenorphine is the only drug, at the recommended dose, that significantly reduced pain following laparotomy testing. Though not statistically significant, it appears as if buprenorphine reduced acute pain during hot plate testing.
Conclusions: Preliminary data indicate higher doses than currently recommended may be needed to achieve proper post-surgical analgesia. Therefore post-surgery analgesic recommendations for rats may need revision.

**Service Learning & Honors Academy Leadership Projects—Exhibit 58**

**Brittany Jones, Brenda Hall**
The University of Alabama at Birmingham
Project Mentor: Debra Lake, Jerry King

Camp WhezzAway

Our community service project involved us helping kids with moderate to severe asthma. These kids were able to enjoy themselves at a camp, with the supervision of healthcare professionals. We helped the children perform their peak flows in the morning and afternoon, and we also helped to administer their medicine. We used the skills that we learned from our classes to teach these children how to manage their asthma. This poster reflects all the different aspects of our service learning experience, and shows the rewards, challenges, and purpose of our experience.

**Service Learning & Honors Academy Leadership Projects—Exhibit 59**

**Sandra LeBerte, Cailtlin Yeager, Kelsey Pennington, Danielle Foster**
University of Alabama at Birmingham
Project Mentor: Debra Laken, Jerry King

Keep Calm and Carry You Inhaler

We as a group of UAB respiratory therapy students went to an asthma camp called Camp Wheeze-Away located at YMCA Camp Chandler in Montgomery. We taught children with moderate to severe asthma how to better control their asthma while enjoying fun outdoor activities at the camp. This was a very rewarding experience for our group.

**Service Learning & Honors Academy Leadership Projects—Exhibit 60**

**Adrian Lewis, Whitney Peterson, and Justin Crossley**
The University of Alabama at Birmingham
Mentor: Adrian Lewis, Jordan Unlap, Catlin Adamson, Julia Goggins

## Kicking Asthma and Taking Names

In the U.S. there are about 25 million people with asthma. About 7.1 million of them are children. Many of these children who suffer with this condition do not know what asthma is, what causes asthma, and how to manage it. Our goal was to teach a group of children with asthma about their disease ranging from what asthma is and its triggers to proper management like taking their inhalers and using their peak flow meters. We used different methods of teaching to reinforce our goal including games with prizes and demonstrations that were hands on and child friendly.

**Service Learning & Honors Academy Leadership Projects—Exhibit 61**

**Beatriz Maciel , Chinazor Iwuaba**
University of Alabama at Birmingham
Mentor: Debra Laken, Jerry King

## Reach Your Peak Asthma Camp

The primary goals of Children's Hospital Asthma Camp was to educate the asthma campers and their parents about asthma, demonstrate the proper techniques required to operate their medical equipment with their prescribed medication, and to motivate the children and the family members that asthma can be controlled with accurate knowledge of this disease. The children were trained on the acceptable method of using a spacer and a metered dose inhaler, whether the spacer included a mask or a mouthpiece. Teaching activities for the campers were focused to incorporate the children's daily activities so they learn to recognize symptoms that may lead to an asthma exacerbation. The children with this teaching gained knowledge on how to respond to a trigger and what steps to take in order to prevent an asthma attack.

**Tammy Renda, Pierre Wilson, Michelle Uzoh**
University of Alabama at Birmingham
Reach Your Peak Asthma Camp
Mentor: Debra Laken King

Reach Your Peak Asthma Camp

Moderate to severe childhood asthma is a disease that can inhibit the lifestyle of a child and his or her family. Reach Your Peak Asthma Camp sponsored by Children's Hospital of Birmingham allows these children from the inner city to experience a day camp environment in a controlled atmosphere. As Respiratory Therapist at UAB, we have studied the pathology, etiology and clinical manifestations of asthma. We have also worked in hospital clinical situations; although what we have not done is to interact with moderate to severe asthma pediatric patients during daily activities outside of the clinical setting. Reach Your Peak Asthma Camp allowed us to use our knowledge as Respiratory students to volunteer and give a safe environment for children to learn and play, as we pretreated, monitored their symptoms and gave them confidence. The confidence we enforced was provided by teaching them how to recognize their triggers, how to use their medications properly and that they in fact could safely interact with other children in activities. Moderate to severe pediatric patients feel limited in their ability to live as other children, as demonstrated by their Wish Stars that listed what they wanted to change about their asthma: having pets, friends who understood and simply running, were among the wishes. While not every wish could be granted, we hoped to educate them and their families on how to better manage their asthma to live their lives as normally as possible.



**Caleb Watson , Katie Brand, Karl Hare**
University of Alabama at Birmingham
Mentors: Jerry King, Debra Laken

Empowering Youths with Asthma

In order to set the stage for proper asthma management, Reach Your Peak Asthma Camp funded by Children's of Alabama and led by health care professionals, meticulously trained in asthma education, guide children aged 5-12 through a predetermined pathway towards controlling their disease. Asthma education has been shown to be one of the best routes of achieving this goal. However, acquiring and maintaining the attention of this age group proves difficult. Throughout the camp, keeping the children interested was one of the biggest challenges that needed to be overcome. In order to overcome this challenge, the host of the camp was the McWayne Science Center where the children had a preset amount of time away from the asthma classes to let their imagination soar. The asthma classes taught the children about the disease process and various ways to have well-controlled asthma through games, hands-on-projects, and lectures. Through these teaching techniques, a young generation is empowered to manage their asthma and realize that even though this disease will be with them for the rest of their lives, it does not have to control them—achieving an ultimate goal of being able to do the things that any other child is able to do.

**LaShaydra White, Caletheia Harrison, Tuan Nguyen, Melanie Stinson**
University of Alabama at Birmingham
Mentor: Debra Laken, Jerry King, Jabril Cooper

# Helping the Community Breathe Better: One Inhaler at a Time

Camp Wheeze-Away was a camping event held at Camp Chandler in Wetumpka, Alabama for children from ages 8-12. Camp Wheeze-Away provided a supervised outdoor camping experience for children who were living with moderate to severe asthma and financial burdens. We as respiratory therapy students volunteered to provide quality medical services to the camp. Our responsibilities included monitoring the children's asthma condition, while at the same time providing quality education their families could not afford. The objective was also to provide this type of education in a fun and relaxed atmosphere to ensure the children fully understood their condition. We were able complete this objective by applying our knowledge of disease management and therapies in a non-traditional clinical setting such as Camp Wheeze-Away. The children participated in numerous of physical activities that one would normally see in camp. For example archery, hiking, swimming were things that the children were able to participate in while under our medical supervision. However, we as respiratory therapy students encountered challenges and rewards during our stay. One of the most challenging obstacles about this experience was trying to grasp the children's attention span while teaching them about their asthma. With difficulties came reward, as we felt that we were able to communicate effectively with not only children, but also other health professionals such as, nurses and physicians.

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UAB Undergraduate
Scientific Research Journal

*Inquiro*, an annual peer-reviewed undergraduate science journal, is accepting submissions for its 2013 edition. UAB undergraduates participating in scientific research and non-UAB undergraduates participating in research *at UAB* are invited to submit manuscripts to be considered for publication. Papers will be accepted on the basis of anonymous reviews by UAB faculty.

The deadline for submission is October 9, 2013; however, students participating in summer research programs are encouraged to submit sooner.

The journal accepts the following types of submissions:

**Short reports:** Short research papers give a brief overview of a project and are comparable to the content of science posters. The suggested length is 1000-2000 words.

**Long papers:** Long research papers result from substantial projects. The suggested length is 2500-4000 words.

**Research Narratives:** These are editorial or narrative pieces related to scientific research. The suggested length is 600-800 words.

We also welcome **original artwork** submissions. One will be chosen to be featured on the cover of the journal, and another on the inside cover. The winners of the cover art contest receive cash prizes of $125 and $75, respectively.

*Inquiro* does **not** accept literature reviews, survey-based studies, or papers based on research in the social sciences or humanities.

Short reports and long papers are submitted online at our website: www.uab.edu/inquiro. Research narratives and artwork may be submitted by email to sciencejournal.inquiro@gmail.com.

Please view our manuscript guidelines before submitting. These can be found on our website, where you can also peruse past issues of the journal at our archives.

Students and faculty are encouraged to email us with any questions or comments. Students who wish to join the *Inquiro* staff and faculty who are interested in becoming reviewers may also contact the editors at this address.

We look forward to receiving your submissions!

Chapin Cavender and Miranda Collier, *Inquiro* Chief Editors
2013 *Inquiro* Editorial Board