

**University of South Alabama
University Committee on Undergraduate Research**

10th Annual Undergraduate Symposium 2008

Musical Performance

2008

“Music for Motion Pictures”

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Using computer software, Hironori Anazawa rescored the music from five films and one television commercial. The following types of scenes were rescored: Suspense from “*Proof of Life*,” Horror from “*Hollow Man II*,” Thriller and Mystery from “*The Village*,” Romance from “*Addicted to Love*,” Comedy from “*Heinz*” (TV commercial), and Chase from “*Spy Kids*.” The goals were to compose for a variety of emotions and actions, create realistic-sounding orchestral instruments, and produce professional-quality sound tracks. In the examples where a film’s original music was present, the existing soundtracks were silenced.

Mentor: David Durant

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Poiseuille Flow in a Duct to Simulate Blood Flow

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The controversy over the use of nonpulsatile (steady flow) versus pulsatile (pulsed or unsteady) pumps for extracorporeal circulation during medical procedures has been long standing. This has led us to initiate a study into the performance of several commonly used perfusion pumps. Using harmonic analysis, we have shown that performance characteristics of these pumps differ from one another and from those of the heart. We have noted that high frequency, low amplitude pressure pulses exist in some of the pumps, but not in the heart itself. It is hypothesized that this factor may cause changes in the endothelial cells of the lung vasculature. In order to test this hypothesis two paradigms were defined, an experimental model and a numerical analysis model. The experimental model was tested for several years, but we had to postpone the numerical modeling.

In an attempt to evaluate potential effects on the endothelial cells from a fluid dynamics standpoint, numerical simulations of flow through a vascular segment will be generated. The blood flow in a vein or artery segment will be modeled as unsteady viscous, two dimensional flow in a rigid pipe using a well-known computational fluid dynamics code, INS2D. In the past, the unsteady boundary conditions were driven by the velocity entering the pipe, but for this effort, the unsteady nature of the flow must be pressure driven. The unsteady pressure boundary condition has been defined mathematically, but has never successfully been applied in a numerical code. In addition, the initial conditions for the flow field (laminar viscous flow, as demonstrated by the Poiseuille velocity distribution) must be defined and input to the code. The objective for the summer effort is to develop the Poiseuille distribution for the initial conditions of the flow, and transform the mathematical unsteady pressure distribution into matching coordinates and variables consistent with the INS2D code. The long term objective of this analysis will be to determine if we can see changes in the wall shear stress as a function of the individual high frequency pressure pulses.

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**Use of Event-Related Potentials and Neuropsychological Test Performance
To Identify Simulated Malingerers Revisited**

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Research has substantiated an increase in malingered neurocognitive deficits among medico-legal patients. As a result, methods that detect feigned cognitive impairment have become increasingly necessary when conducted neuropsychological assessments. This within-group study had volunteers perform twice on a forced choice recognition memory test, which is designed to detect poor effort (i.e., Word Memory Test; WMT). Under one condition, participants were told to do the best they could. Under a second condition, they were told to feign memory impairment due to an alleged traumatic brain injury. During both conditions, participants' brain activation was monitored via EEG, using event-related potentials (ERP). A positive change in electrical brain activation, which occurs 300 ms after exposure to a stimulus (i.e., P300), is an indication that a stimulus has been seen before. These measurements were then correlated with participants' memory responses to determine if feigned memory loss could be reliably detected. Results indicate that P300s were equivalent for the malingered and full effort conditions, demonstrating the efficacy of this technique for detecting a participants' actual level of knowledge, independent of behavioral response.

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Reduced Angiogenesis in the Healing Wounds of Tight-skin Mice is Due To Increased Endothelial Cell Apoptosis

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Scleroderma is a connective tissue disorder of unknown pathogenesis that is characterized by excessive tissue fibrosis and vasculopathy. Fibrosis is the most prominent characteristic of scleroderma and is due to excessive deposition of extracellular matrix (ECM) components, particularly collagen. The vasculopathy associated with scleroderma involves a progressive loss of blood vessels with an unknown etiology. Tight-skin (Tsk 1/+) mice are a widely utilized animal model of the fibrosis and vasculopathy associated with scleroderma. Excisional healing wounds were made in wild-type and Tsk 1/+ mice with the aid of a 6 mm biopsy punch. The animals were then euthanized, and the wounds were excised, fixed, and sectioned. Hematoxylin and Eosin staining revealed that there is a marked increase in the deposition of ECM in the Tsk 1/+ wounds. Neovascularization was assessed by staining sections with antibodies to platelet endothelial cell adhesion molecule-1 (PECAM-1). PECAM-1 analysis revealed that there is a decrease in neovascularization in the Tsk 1/+ mice in comparison to the wild-type mice. A terminal transferase mediated dUTP nick-end labeling (TUNEL) assay was next performed and subsequent analysis via fluorescent microscopy indicated a significant increase in the apoptotic indices of Tsk 1/+ wounds. In an effort to determine whether reduced angiogenesis in Tsk wounds is due to elevated endothelial cell apoptosis, we plan to combine a TUNEL assay with PECAM-1 staining.

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Formal Synthesis of Chelonin B and Combretastatin using Sulfur Ylide Technologies

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Reaction of sulfur ylide with aldehyde, imine, and ketone functionality affords the desired three-membered carbocycle in excellent yield. The sulfur ylide is generated in situ upon decarboxylation of carboxymethylsulfonium betaine functionality. Of the seven carboxymethylsulfonium betaine derivatives surveyed, the highest level of conversion of π -acceptor to carbocycle was obtained having S-methyl and S-phenyl functionality bound to a thioacetate derivative. Sulfonium methylidene aziridinations and epoxidations involving the decarboxylation of carboxymethylsulfonium betaine functionality compliments existing technologies with the advantages of the reaction protocol, levels of conversion and scope. While moderate levels of diastereocontrol were observed in the aziridination of imine functionality, the four oxiranes resolved using Jacobsen's Co(II)-salen complex were obtained in both high yield and enantioselectivity. The isolated chiral non-racemic oxiranes constitute the formal synthesis of chelonin-B and combretastatin starting from 3-bromo-4-methoxybenzaldehyde and 3,4,5-trimethoxybenzaldehyde respectively.

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Population Study of *Ruppia maritima* at Grand Bay National Estuarine Research Reserve

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Seagrass beds are an important part of the ocean's coastal zone, protecting the shoreline from erosion and supporting grazing and detrital food webs. They also serve as nursery grounds for many aquatic species, including commercially important fisheries. Seagrass populations have decreased dramatically due to human development, pollution, and eutrophication. Programs aimed at conserving and restoring this essential habitat have begun to consider genetic diversity as a key component in establishing and maintaining a successful seagrass population. The genetic structure of both the target restoration site and the donor material is important for the successful colonization of seagrass beds. Seagrass restoration using transplanted individuals is much more successful with donor plant material that is genetically diverse. Grand Bay National Estuarine Research Reserve (GBNERR), Grand Bay, MS has been conducting large-scale monitoring of seagrass habitat in the reserve and has noted a decline in its distribution over the past several decades. These seagrass beds are dominated by *Ruppia maritima*, a species for which little genetic research has been done. Initial investigation of the genetic diversity of *Ruppia maritima* in GBNERR was carried out to supplement their submerged aquatic vegetation project. Samples were collected from various locations in the reserve and diversity within these populations was assessed using microsatellite markers and inter simple sequence repeats. Additional samples from other locations along the Gulf Coast were also collected and used for comparison. Information regarding gene flow and any apparent patterns in genetic profiles of these locations will help lead researchers at Grand Bay National Estuarine Research Reserve in any future conservation or restoration projects.

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Effect of Carapace Width on Molt Cycle Duration

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This study investigated the correlation between the carapace width and the duration of the molt cycle of *Callinectes sapidus*, the blue crab. While under constant observation, twenty-three crabs were kept in individual containers, fed calf liver, and allowed to molt. Of the twenty-seven crabs studied, eleven crabs gave usable data. It was found that as the carapace width increased, the molt cycle length, specifically the intermolt stage, was extended. The different stages of the molt cycle were determined by examining the edge of the paddle under a dissecting microscope at low magnification and comparing what was observed with the current staging techniques. The experiment carried out thus far is a small part of a larger experiment involving the use of the molting hormone 20-hydroxyecdysone to accelerate the molt cycle of summer (green) crabs. A “green” crab is a crab that is not soft and is not in the premolt stage. The long term goal of this project is to find a way to decrease the length of time that it takes a crab to go from intermolt (green) to premolt (pink). This study defined the premolt stage in more detail than was previously accomplished. By comparing the size of each crab’s carapace and the length of time that each crab spent in intermolt, it can be established that as carapace width increases, the time that a crab spends in intermolt also increases. No change was observed in the molt cycle duration of the crabs that were administered the molting hormone.

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Using an Acid-Sensitive Species, *Salmonella enterica*, to Study Regulation of *Escherichia coli* Acid Resistance: Identification of a New Regulator of the P3P2 Promoter Region of the *E. coli gadE* Gene

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E. coli has a level of acid resistance superior to that of other *Enterobacteriaceae*, stemming from a unique acid resistance mechanism not present in other genera such as *Salmonella*, *Proteus* and *Klebsiella*. The GadE transcriptional regulator is critical to activation of this system. Surprisingly, when two of the promoters associated with the *gadE* gene were moved into *Salmonella* the promoters were expressed despite the absence of the *E. coli*-specific genes known to activate them. This suggested the presence of an unknown regulatory circuit in *Salmonella* that may also be present in *E. coli*. To identify new potential regulators, *Salmonella* containing the P3P2 *gadE-lacZ* (β -galactosidase) fusion was subjected to random transposon mutagenesis and crossed with a library of cloned *Salmonella* genes. A lactose indicator media (MacConkey agar) was used to screen for altered expression of the fusion. Transposon insertion mutants showing over expression and muted expression were isolated. In addition, a plasmid from the *Salmonella* clone pool repressed expression of the *gadE-lacZ* fusion. The DNA sequence of the plasmid clone indicated that a region present in both bacteria, *ybjN* –*pot operon*- *ybjO*, was responsible. An individual clone of each gene from *E. coli* was introduced into both bacteria. The results indicated that YbjN, a putative sensory transduction regulator, is the negative regulator. This gene had not previously been implicated as playing a role in the regulation of *gadE* or *E. coli* acid resistance. The next step will be to characterize the role YbjN plays in regulating *E. coli gadE* by determining whether it is an unknown component of an existing pathway or serves as part of an as yet unknown pathway.

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The *cdgR* Encoded Cyclic Diguanylate Phosphodiesterase is Required for the Starvation-Stress Response of *Salmonella enterica* Serovar Typhimurium

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Salmonella enterica serovar Typhimurium is known to initiate the starvation-stress response (SSR) when it is starved for a carbon-energy (C)-source. The SSR leads to dramatic morphologic, physiologic and genetic changes in the cell. During C-starvation, changes may result from the activation of the *rpoE* gene product, the alternative sigma factor σ^E , which is part of RNA polymerase and guides it to the correct promoter region on DNA. Previous gene array studies suggested that expression of the *cdgR* (*ydiV*) gene is dependent on σ^E and is C-starvation-inducible. This suggests *cdgR* is expressed during the SSR of *S. Typhimurium*. CdgR is reported by others to be a cyclic-di-GMP phosphodiesterase; this suggests that c-di-GMP levels are critical to the development of the SSR in *S. Typhimurium*. Previous studies have shown that CdgR suppresses bacterial c-di-GMP levels, in turn promoting resistance to a specific stress. Based on this, we hypothesized that the *cdgR* gene product is needed for cross-resistance developed during the SSR. Here we report that the lack of *cdgR* protein prevents or decreases C-starvation-inducible cross-resistance to Polymyxin B as well as hydrogen peroxide in 5-h and 24-h C-starved cells, respectively.

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**Synthesis of Boronium Ion Salts and Ionic Liquids as a Potential Salt Bridge
in New Batteries**

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We are interested in amine-supported boronium ionic liquids because they are intrinsically non-viscous and have positive charges that are more highly delocalized than in conventional imidazolium ionic liquids, resulting in a decreased reduction potential. When testing them as new "salt-bridge" media in batteries these two properties are vital. In starting this project we set out to create symmetrical boronium cations, using N-alkyl imidazoles. During the course of the project, we expanded the scope of work to include the synthesis of boronium ions bearing two tertiary amine ligands.

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Fidelity in Implementation of a Graphophonemic Reading Intervention

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Treatment fidelity, the investigator's adherence to procedure, is critical when evaluating intervention effectiveness. The purpose of this study was to investigate two aspects of treatment fidelity and one measure of effectiveness for a 4-week reading intervention. The intervention is an investigation by the second author of the effects of graphophonemic feedback. Two participants (*M* age = 8 years; 5 months) identified with language impairment and reading disability met with the first and second authors 3 days weekly for 4 weeks for a total of 12, 1-hour treatment sessions. Each session was designed to include 10 minutes of graphophonemic instruction followed by 30 minutes of the children reading. The first author gave specific *graphophonemic feedback* (e.g., "Remember the vowel in an open syllable says its name") when the children produced reading errors (i.e., *miscues*). To assess treatment fidelity, the first author randomly selected 4 of the 12 treatment session audio files and measured (1) the time spent reading and (2) the percentage of miscues followed by graphophonemic feedback. Only 1 of the 4 sessions met the 30-minute reading time criterion: the average time participants spent reading was 28 minutes. Fidelity for graphophonemic feedback was 90%, based on the number of miscues followed by correct cueing divided by the total number of miscues. Results help to establish treatment fidelity for this intervention. That is, time spent reading can be described accurately, and there is evidence of reliable implementation of the graphophonemic feedback. Regarding treatment effectiveness, both participants demonstrated a decline in miscues across the first 3 weeks of treatment; however, miscues increased in the 4th week. It is not likely that participants' reading declined in the 4th week. Instead, the increased reading level associated with week 4 in combination with advances from the first 3 weeks may have resulted in increased miscues. This measure of children's reading during the treatment sessions may not be an accurate way to assess overall treatment effectiveness. Other treatment effectiveness measures (e.g., sight word and non-word reading efficiency) are planned for the broader thesis study.

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Experimental Manufacture of Bone Tools from Prehistoric Sites on the Alabama Gulf Coast

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It is said that the present is the key to the past. Experimental archaeology is one way, then, to unlock archaeological secrets. Using collections from two archaeological sites in Alabama, 1BA21 and 1BA134, to serve as models, bone tools were replicated in modern manufacturing experiments. Bone awls, projectile points, fishhooks, and beads were all recovered from sites 1BA21 and 1BA134. *Odocoileus virginianus* metacarpals were the most frequently occurring element in the collections. Using whitetail deer metacarpals, several bone tool types were manufactured. Materials were utilized that most likely would have been available to past peoples. Chert flakes, sandstone slabs, and deer metacarpals were employed to produce three bone awls, a bone knife, and two bone pins. While a bone knife artifact was not found in the archaeological assemblage, it was hypothesized that bone could produce a sharp cutting edge. In one trial, a metacarpal broke in such a way that a sharp cutting edge was produced when ground on sandstone, with minimal effort. The tools are functional, and were tested in several trials on cutting or piercing leather, cutting roots, and serving as hair ornaments, respectively. More experiments are planned, as this research will continue and the results presented at the 2009 Southeastern Archaeological Conference. The tools currently being produced include projectile points, fishhooks, ornaments, and knives. By conducting these experimental trials, insight is gained on how peoples in the past might have created bone tools. The next step will be further experimental investigation of tool use. Experimental archaeology will continue to play an important role in our understanding of the past, especially with regard to past technologies such as bone tool manufacture and use.

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Using the Bulky Phosphite $P(OC_6H_3-2,4-But_2)_3$ to Determine Relative Affinities of Weakly Coordinating Neutral Ligands for $(\eta^6-Arene)RuX_2$ (Arene=Benzene, p-Cymene; X=Cl, I) via ^{31}P , ^{13}C , and 1H NMR Spectroscopy

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Ligand substitution for synthetically important ruthenium complexes $ArRu(L)X_2$ (Ar = Benzene and Cymene, X = Cl, I) were studied to compare steric and electronic effects. Duplicate experiments were run to determine the equilibrium constant for each neutral-ligand competition using ^{31}P NMR spectra: $ArRu(L)X_2 + P^* = ArRu(P^*)X_2 + L$. The complexes $ArRu(L)X_2$ were prepared in solution by treating the ruthenium halide dimer with two equivalents of neutral ligand L: $[ArRuX_2]_2 + 2L \rightarrow 2ArRu(L)X_2$. The CymRuX₂ was commercially prepared, but the BzRuX₂ was prepared in lab. The equilibrium experiments were carried out by recording spectra for solution mixtures of either (i) $[ArRu(L)X_2] + P^*$ or (ii) $[ArRuX_2]_2 + 2L + 2P^*$. For the latter, equilibrium constants were calculated using conventional stoichiometry by considering that the ruthenium halide dimer was completely converted to $ArRu(L)X_2$, which then interacted with P^* . $ArRu(L)X_2$ complexes are readily prepared by combining $[ArRuX_2]_2$ and a small to moderate stoichiometric excess of L in solution then precipitating. Samples were characterized by 1H , ^{13}C , and ^{31}P NMR spectra. The ^{31}P -NMR singlets can be hand-integrated to provide mole fractions of P^* and Ru- P^* used to calculate K. ^{31}P integrals corroborated by 1H -NMR integrals for p-cymene protons of CymRu(L)X₂ and CymRu(P^{*})X₂ and aryl-ring and aryl-But protons of P^{*}. ^{31}P integrals corroborated by 1H -NMR integrals for benzene protons of BzRu(L)X₂ and BzRu(P^{*})X₂ and all the P^{*} protons. Comparison of K_{Cl} and K_I indicate the major Hard Soft Acid Base (HSAB) effect of the softness of the halo ligands upon relative bonding strengths of L and P^{*} to the Ru(II) center, in that $ArRuI_2$ is considerably softer than $ArRuCl_2$. Significantly greater steric hindrance of CymRuI₂ relative to CymRuCl₂ and CymRuX₂ relative to BzRuX₂ is expected for binding the very bulky P^{*}. However, when P^{*} competes with a smaller, harder N-ligand, $K_I > K_{Cl}$ in spite of the strong steric effect opposing the soft/soft interactions. When P^{*} competes with a smaller soft ligand (S, As, & Sb), the soft/soft driving-force advantage for Ru-P^{*} formation diminishes or disappears, and steric effects predominate to afford $K_{Cl} > K_I$. K_{Cym} was found to be far larger for all ligands than K_{Bz} indicating that the steric interactions are the driving force relative to these two compounds.

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JagBot – An Autonomous Robotic Campus Tour Guide

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The JagBot project is a challenging interaction of a robot with a dynamic environment of a university campus. The JagBot will interpret these conditions and react accordingly through the use of visual and audio stimuli in real time. Visual cues such as object detection, color recognition, and edge detection will require the robot to process images that are captured by on-board cameras. Speech recognition software will allow tour participants to ask and have the robot answer various questions relating to the campus tour. GPS will allow JagBot to know its exact location to aid in navigation and to answer site-specific questions. The use of sonar and infrared sensor arrays will allow JagBot to avoid and navigate around obstacles. The JagBot project has provided students with practical design and implementation skills in the field of robotics. This reinforces the core development concepts relevant in the fields of computer and electrical engineering.

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Reformer Design for Autothermal Reforming of iso-Octane to Generate Hydrogen for Fuel Cell Applications

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In this research a packed bed reactor is designed and analyzed, in which autothermal reforming of iso-octane occurs to produce sufficient hydrogen for generating 1 kW of power for stationary power applications. Mass and energy balance equations are developed for each species in the reactor. The pressure drop is modeled via the Ergun equation. Simulations are conducted in ASPEN to determine the effect of process parameters (e.g. steam to octane ratio, oxygen to octane ratio, inlet pressure, inlet temperature) on the production of hydrogen. An appropriate reactor jacket is designed where iso-octane is oxidized to produce sufficient heat for the steam reforming reactions in the reactor. The flow rate of octane in the jacket is computed so that sufficient heat is generated for complete conversion of octane under non-isothermal conditions. Calculations are done for the energy required to bring the fuel processor system from ambient temperature to the operating temperature where fuel cell quality hydrogen can be produced.

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Assessing the Frequency of Clonal Reproduction in *Fagus grandifolia* in the Great Smoky Mountains National Park Using Microsatellites

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In many plant species, asexual reproduction through clonal growth is thought to be correlated with extreme environmental conditions (e.g. nutrient-poor habitats, aquatic regions, arctic regions and shady habitats). *Fagus grandifolia* (American beech; Fagaceae), a common tree species in eastern North America, is known to reproduce both sexually by seed and asexually by root sprouting. This species can be found growing in high elevation monocultures, known as beech gaps, in Great Smoky Mountains National Park. These beech gaps are suspected to be highly clonal, based on the observed densities and stunted growth of these stands. Our goal was to use microsatellite markers to evaluate the degree of clonality in these stands compared to those found in more optimal environments. Six sites in the Great Smoky Mountains, stratified by elevation (high, middle and low) and aspect (north and south), were sampled. Eight loci were used to assess genetic variation within and among these six sites. Preliminary assessment of the data suggests that populations at higher elevations, and populations with samples within close proximity of each other, are more clonal than are low elevation populations, which is consistent with historical observations of these unique habitats.

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Comparative Analysis Of Emergency Preparedness Public Policies And Industry Standards For Long Term Medical Care Facilities

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In response to the multiple deaths of vulnerable residents of Louisiana long term care facilities following hurricane Katrina, this multi-faceted research project includes a descriptive public policy review of regulatory guidelines regarding disaster management and emergency preparedness for long term care medical facilities. A comparative study of the post-Katrina standards for such facilities in both Alabama and Louisiana indicates a vast difference in the current regulatory standards of the two states. Further comparison between the Alabama standards and the current recommended standards and guidelines of the disaster management / preparedness industry also indicate the need to upgrade the state's standards—particularly for facilities in the vulnerable Gulf Coast region. The study is based on a review of existing public policy documentation; peer-reviewed journal articles; published books from relative fields of study; and personal interviews with professional experts in relative fields of study. Also researched were online sources, including private agencies, such as American Red Cross; Emergency Preparedness Research Departments from several universities; and governmental agencies such as the Federal Emergency Management Agency, Centers for Disease Control, Department of Health and Human Services, Occupational Safety and Health Administration, Department of Homeland Security, U.S. Administration on Aging, Alabama Department of Public Health, Louisiana Homeland Security, and U.S. Fire Administration.

Results of this study will be utilized in a case study of the Allen Memorial Home, a nursing home in downtown Mobile, Alabama. The facility's existing disaster and evacuation plan will be evaluated by its Board of Directors for compliance with current public policy regulations and industry standards. The case study will culminate in specific evidence-based recommendations for the Allen Memorial Home to further ensure the safety and security of staff and medically fragile residents in the event of disaster.

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Role Of Iron On Oxygen-Induced Acid Survival Of *Campylobacter jejuni*

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Campylobacter jejuni is a gram negative, microaerophilic, enteric pathogen that grows optimally at pH 7 under microaerophilic (5%O₂) conditions. However, *C. jejuni* survives the low pH of the stomach in order to cause gastroenteritis. Our lab has previously shown that exposure to atmospheric oxygen (20%) results in induction an survival mechanism and allows *C. jejuni* to survive a low (pH3.5) acid challenge. Others have shown that *C. jejuni* requires a functioning ferric uptake regulator, *fur*, gene in order to colonize the intestine of poultry. Iron is also known to be involved, mostly as a cofactor, in oxygen metabolism. We hypothesized that iron plays a role in the oxygen-induced acid resistance of *C. jejuni*. This study, therefore, focused on delineating the role of iron in oxygen- induced acid resistance in these organisms. Dipyriddy is an iron chelator, and it can be used to effectively make the iron in the media inaccessible to *C. jejuni*. We challenged adapted and unadapted *C. jejuni* with lethal pH of 3.5 with or without dipyriyl. Our results indicate that iron is necessary for oxygen-induced acid survival of *C. jejuni*.

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Progress Towards Fabrication of Thin Films of Superconducting V_3Si Using Pulsed Laser Deposition

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Progress towards fabrication of thin films of V_3Si via pulsed laser deposition (PLD) is reported. This is part of an ongoing project in which magnetic flux quanta in type II superconductors are driven towards an *ordered flux flow* phase wherein the mutually repulsive flux quanta move in a highly coordinated manner. Achieving this requires current densities on the order of a few *thousand A/cm²*. The new electric transport system at the Department of Physics, with a 9-Tesla superconducting magnet, can achieve this by reaching currents in excess of 50 A. Although much progress has been made in overcoming the technical issues of using such high currents, those same issues still limit the phase space in which flux flow could be observed. The present samples are bulk, single crystals, with cross-sections on the order of square millimeters. *Thin films* of these materials would reduce the cross-section by at least *two* orders of magnitude, thus making accessible levels of current density that are two orders of magnitude higher.

To this end, films of the superconductor V_3Si are being developed using the PLD system at the Department of Electrical and Computer Engineering. Thus far, X-ray diffractometry indicates successful production of V_3Si phases, albeit limited – most likely due to great sensitivity of the process to the presence of *oxygen*. Measures being taken to address these issues are described.

Aside from the flux-flow project, another source of interest in this endeavor is the fact that there are no known V_3Si films currently in existence, and, even when few were once fabricated (in the 1960's), *none* have ever been made using the PLD process.

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Partial Characterization the Bacterial Community Associated with Leaves of the Seagrass *Thalassia testudinum*

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The eukaryotic protist, *Labyrinthula* is the best possible candidate for spreading the infection of the epidemic wasting disease of the 1930's. The infection had a critical impact on the marine environment leading to loss of large tracts of seagrass along the east coast of the North America and west coast of Europe. The sliding motility of *Labyrinthula* allows it to invade the host tissue through holes on the leaf surface and initiate infection. However, the holes on the leaf surface, observed by transmission electron microscopy, are a size that is more consistent with the bacteria on the periphery and within the outer cell walls than the much larger *Labyrinthula*. This observation suggests that the bacteria possibly produce the holes on the leaf surface and that these holes are used by *Labyrinthula* to enter the tissue. Hence, my project focused on identifying possible wall-drilling bacteria associated with the seagrass, *Thalassia testudinum*. To accomplish this, Marine agar was used to make Petri plates for isolations. Then, leaf pieces of *Thalassia testudinum* and different specie called *Halodule* were streaked onto the plates and the plates were incubated at 21°C. From this, I isolated 5 different bacterial types, based on colony color and morphology. In another approach, leaves of *Thalassia* were surface sterilized to eliminate bacteria that were not residing inside of the leaf. This was done using a 5% bleach solution. Leaf pieces were immersed into the solution and sterilized on the shaker for three, five, ten, and fifteen minutes. The sections then were rinsed with seawater and placed separately on dishes with Marine agar medium to observe growth. This approach produced only five different bacterial types that were able to survive for three, five and ten minutes in the bleach treatment. Fifteen minutes of bleach treatment killed all bacteria showing no growth on the plates. Thus, for survived bacteria, polymerase chain reaction (PCR) was used to amplify DNA for 16S ribosomal sequence to produce a 900 base pair product. Three out of five bacteria yielded products of the appropriate size, which were then sequenced. From this, we hope to determine the identities of the bacteria found within the *Thalassia* tissue and to determine if they are among known cell wall-boring and wood-degrading bacterial genera.

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Polymer-Supported Sulfenylations

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The purpose of this research is to study and explore the sulfonium salt mediated dealkylation process. The product formed was phenyl succinimidyl sulfide. The phenyl succinimidyl sulfide was used to sulfenylate activated methylene groups. When used with diethyl benzylmalonate, the sulfenylated product can be selectively oxidized and thermally fragmented to yield diethyl benzylidenemalonate. The above developed method was applied using a polymer-supported thioanisole derivative (JandaJel). Formation of the enediacarboxylate documents proof of principle of polymer-supported sulfides as sulfenylating agents onto activated methylenes. Further research can be done to apply the method of application to the synthesis of compounds of medicinal and biological importance.

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Speech Recognition and Synthesis in the context of a Tour Guide Robot

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Microsoft SAPI (Speech Application Programming Interface) allows for easy access to the speech synthesis and recognition features built in to every version of Microsoft's Windows Vista. The library allows for individual words to be recognized, and for *grammars* to be programmed. These grammars allow for a programmable way to dynamically combine words and phrases and determine appropriate responses; a way to "understand" what was said. In the noisy environment of a college campus, a set of grammars were written with the intention of mounting a laptop and microphone atop a robot that would serve as a tour guide for students. The robot would use GPS and other tools to determine its location, and the speech system would adjust its grammars and preset responses depending on this information. The responses and grammars were designed to allow for multiple variations of questions, taking into account the noisy environment and having the goal of a speech system that would not require user training – so that anyone could simply walk up and start talking to it.

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Student Activism On The University Of South Alabama Campus, 1964-1971

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Student activism on the University of South Alabama took a unique form. In contrast to activism on the campuses of large non-commuter universities with a tradition of protest, the University of South Alabama came into existence in 1964, precisely the time of the rise and decline of the Pinnacle of Liberalism in the United States. This influence can be seen in the initial group of USA students, as well as subsequent classes that would follow them. In addition to this, there is the irony that USA opened its doors as an integrated institution, barely one year after Governor Wallace's infamous "stand in the schoolhouse door" in an attempt to prevent the desegregation of the University of Alabama.

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The Role of Catalase and Glutathione Peroxidase in Cellular Resistance to Oxidative Stress

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Catalase (CAT) and glutathione peroxidase (GPx) are proteins that act as enzymes. They catalyze the reactions that help break down and detoxify harmful byproducts in the cell, especially the mitochondria, yielded from cellular respiration. These enzymes are thought to significantly contribute to the protection of mtDNA from oxidative stress-induced mutagenesis. Via clonogenic assay, our data revealed that when the cell samples (immortal mouse embryonic fibroblast) were exposed to various levels of oxidative stress induced with either hydrogen peroxide, menadione, or paraquat, some genetically deficient (DK, CAT, GPx) samples of cell lines failed to survive in respectable numbers. Southern blotting revealed no mtDNA damage in Menadione treated cells. Also, in these cells decrease in survival does not correlate with increase in ROS production (particularly at 10 μ M). This leads us to conclude that an alternative pathway may be responsible for the toxicity of Menadione. Results from the treatment of WT cells with Paraquat suggest that Paraquat is not as toxic to the cell as H₂O₂ or Menadione. In both H₂O₂ and Menadione-treated cells a concentration threshold is observed where cell survival is strongly inhibited regardless of the antioxidant status of the cells. Although there is a trend of decreased survival of knockout cells upon H₂O₂ and Menadione treatments, these differences do not reach statistical significance.

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Survey of Freshwater Turtles along Coastal Alabama and the West Pascagoula River

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The Southeastern United States is the region of the world that manifests the greatest species diversity of freshwater turtles. Aquatic turtles are very important in the ecology of their habitat. Therefore, an ecological survey was conducted to assess the freshwater turtle communities of four representative riverine systems along Coastal Alabama and Coastal Mississippi. The rivers included the Magnolia River, the Tensaw River, and the Fowl River in Alabama, and the West Pascagoula River in Mississippi. Aquatic hoop trap/lead net assemblies were used as the trapping method. Traps were dispatched in coves where vegetation was abundant and where human activity was minimal. The trapping period for each river was two weeks (minimum). Species diversity, relative abundance, and sex ratio were calculated for each river. A total of 193 turtles were captured accounting for 8 turtles of 7 species: *Pseudemys concinna concinna*, *Pseudemys alabamensis*, *Macrolemys temminckii*, *Pseudemys concinna floridana*, *Apalone spinifera*, *Chelydra serpentina*, *Trachemys scripta elegans*, and *Graptemys flavimaculata*. The eastern river cooter (*P.c. concinna*) was the dominant species with a relative abundance of 51.3%. Along with the eastern river cooter, *Pseudemys alabamensis* (22.3%), *Macrolemys temminckii* (13.5%), and *Pseudemys concinna floridana* (7.8%) accounted for 94.9% of the collected turtles. Four other species: *Apalone spinifera* (2.6%), *Chelydra serpentina* (1.0%), *Trachemys scripta elegans* (1.0%), and *Graptemys flavimaculata* (0.5%) accounted for the remaining 5.1% of trapped turtles. The catch per unit of effort (CPUE) was 1.26 for the Magnolia River, 0.28 for the Tensaw River, 0.87 for the Fowl River, and 0.13 for the West Pascagoula River. The sex ratio for the combined data was 52% males (48% females). However, the specific sex ratio for *Pseudemys alabamensis* was 69.7% females. Species diversity ranged from 3 in the Tensaw River to 6 in the Fowl River. The Magnolia and Fowl Rivers shared 4 turtles. Future studies might pursue a long-term survey of these river systems and employ more than one trapping technique.

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Geology of the Fruithurst, Alabama 7.5' Quadrangle

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The Talladega Belt consists of metasedimentary and metavolcanic lithologies that represent the southeastern-most extent of the ancient Laurentian continental margin as it existed during mid-Paleozoic time. The Fruithurst quadrangle is positioned within this belt southeast of the Talladega Thrust fault and a megascopic recumbent anticline that folds the pre-Lay Dam formation unconformity, a regional mid-Paleozoic erosional surface that locally truncates Cambro-Ordovician lithologies. Detailed mapping with GPS and pocket transit instruments in the Fruithurst area has delineated many sub-units of metagreywacke and one metavolcanic unit that indicate variable depositional environments in a rapidly subsiding depositional basin during Siluro-Devonian time. A likely tectonic environment would be a back-arc basin – especially considering the appearance of volcanic sub-units within the Lay Dam formation. Structural trends within the area indicate an increasingly oblique bedding-cleavage angle to the southeast, probably indicating that the megascopic recumbent anticline recently discovered to the northwest of the Fruithurst quadrangle has a companion recumbent syncline to the southeast with the Fruithurst quadrangle straddling the northwest limb of the structure. Future mapping to the southeast of the Fruithurst area will be necessary to verify the hinge line of the structure. Intriguingly, the Murphy Syncline structure in North Carolina and Georgia is in the same structural position as the proposed syncline. If these are equivalent structures the paired recumbent anticline-syncline pair persist from the Fall Line near Jemison, AL to at least Murphy NC- a distance of over 200 km.

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The Roles of GGDEF- and/or EAL-Domain Possessing Proteins in Carbon-Starvation-Inducible Stress-Resistance in *Salmonella enterica*

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Salmonella enterica serovar Typhimurium is an enteropathogen, which infects the gastrointestinal tract of humans and animals. Throughout its life cycle, this bacteria encounters several different environments, both host and non-host, and is exposed to numerous environmental stresses. If unable to defend itself against these stresses, the bacterium will be unable to survive and/or will lose its pathogenic properties. One such example of an environmental stress is the lack of an available carbon-energy (C) source. When exposed to a lack of this available essential nutrient, *S. Typhimurium* activates sets of genes whose collective functions are known as the starvation-stress response (SSR). This response serves two purposes, first to fight against the long term effects of carbon starvation, and second, to generate a general cross resistance to other harmful environmental stresses which the bacteria might encounter. The SSR is known to be regulated by different sigma subunits of the RNA polymerase, specifically sigma S and sigma E. In addition, the SSR can be regulated by cAMP-cAMP receptor protein (CRP) complex by controlling RNA polymerases's ability to bind to gene promoter sites. Several genes have been identified on the *S. Typhimurium* chromosome, which are both carbon starvation inducible (CSI) and sigma E and/or sigma S regulated. Of these, several have been identified that may have a potential function to regulate the production and/or degradation of a newly discovered bacterial second messenger molecule cyclic diguanylate (c-di-GMP). This second messenger molecule has been shown to function in several bacterial processes including biofilm formation, motility, and virulence. Proteins that possess diguanylate cyclase activity (converts two GTP into c-di-GMP plus two pyrophosphates) are found to possess a GGDEF domain (contains a glycine-glycine-(aspartate/glutamate)-glutamate-phenylalanine pentapeptide motif), while proteins that degrade c-di-GMP to pGpG (c-di-GMP phosphodiesterase or PDE-A) are found to possess an EAL domain (contains a glutamate-alanine-leucine tripeptide motif). The aim of these experiments was to see if the disruption of CSI genes whose products possess either or both a GGDEF or EAL domain and, thus, potentially function in the regulation of cellular levels of c-di-GMP, will affect the ability of *S. Typhimurium* to generate a maximal SSR. The results showed that knock-out mutations in the *cdgR* (an EAL domain protein with known PDE-A activity), *cdg-04* (a GGDEF domain protein), and *cdg-06* (a GGDEF & EAL domain protein) genes destroyed the ability of *S. Typhimurium* to generate a successful SSR. This indicates that c-di-GMP levels play an important role in the generation of the SSR of *S. Typhimurium*.

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**Characterization of the *Rickettsia prowazekii* Two-Component Response
Regulatory Protein Annotated as OmpR**

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Members of the genus *Rickettsia* are obligate intracellular organisms that cause diseases such as Rocky Mountain spotted fever and epidemic typhus. As a consequence of a parasitic lifestyle, *Rickettsia* have undergone a process known as reductive evolution which has led to a reduced genome size due to the loss of many *de novo* biosynthetic pathways and regulatory functions. Our goal is to characterize one of the remaining regulatory proteins in *R. prowazekii*, annotated as OmpR (RpOmpR), homologous to those found in *Escherichia coli* and *Salmonella*, as to whether it truly functions as a DNA binding protein. OmpR belongs to a family of two-component response regulators – systems that enable bacteria to sense and respond to environmental signals. We employed a complementation strategy where RpOmpR was over-expressed in *Salmonella* and assayed for effects on various Promoter::*lacZ* fusions using a colourimetric β -galactosidase assay. Our collected data demonstrated that: 1) RpOmpR was indeed a DNA binding protein; 2) RpOmpR showed specificity with regard to target genes; and 3) RpOmpR behaved as a repressor of gene expression in this model system.

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Moving Superconducting Flux Quanta, Driven by High Density Currents, in Low-impurity Samples of V_3Si , $LuNi_2B_2C$, and $NbSe_2$: Ordered Flow and Flux-core-size Effects

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There is incomplete understanding about the dissipative motion of magnetic flux quanta in type II superconductors, especially under large Lorentz forces. This is mainly due to the technical challenges involving the application of large electric currents and the rarity of samples wherein flux quanta are relatively free to move – i.e., samples with weak “pinning” – which commonly make it impossible to observe dynamic phases. Progress has been made towards overcoming these challenges, making it possible to obtain clear observations of flux-flow phases in high-quality samples of three “low T_c ” superconductors, V_3Si , $LuNi_2B_2C$, and $NbSe_2$. These phases reveal interesting, diverse behavior: (1) The $LuNi_2B_2C$ data strongly supports a model by Kogan and Zelezhina [*Phys. Rev. B* vol 71, 134505 (2005)] predicting the effect of a field-dependent flux *core size* on ordered flux flow; (2) the V_3Si data shows evidence of ordered flux flow, but with a significant viscous force; and (3) in $NbSe_2$ there is evidence of the flux flow being affected by doping and/or strain.

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Measurement of the Efficiency Ratio Decay of the Upsilon(4S) Resonance at the BABAR Experiment

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Based on a data sample of 88 million $B\bar{B}$ pairs collected at the Upsilon(4S) resonance with BABAR detector at the PEP-II asymmetric-energy B Factory at Stanford Linear Accelerator Center, we measure the efficiency ratio decay of Upsilon(4S) $\rightarrow B^0\bar{B}^0$. The B mesons are reconstructed through the channel $B^0\bar{B}^0 \rightarrow D^{*+} \Gamma \nu_l \bar{B}$ using a partial reconstruction method, where the D^{*+} is detected only through the soft pion daughter from the decay $D^{*+} \rightarrow D^0 \pi^+$. By comparing the number of single and double reconstructed B mesons and using an independent value of the branching fraction of Upsilon(4S) $\rightarrow B^0\bar{B}^0$, we obtain the efficiency ratio decay of Upsilon(4S) resonance to be $C = 1.9762 \pm 0.0589$.

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Building a Better Flume

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Sedimentary flumes are devices that pass a confined current of water over substrates consisting of different geological materials like sand, shells, or gravel. They are useful for both geological and geotechnical purposes because they allow direct observation of how and when sediment first moves in currents (i.e., erosion), and how and when it stops moving during deposition. Flumes come in all sizes and range in cost from a few dollars to many millions of dollars. Small units are common in universities where they have proven to be useful teaching and undergraduate research devices. The problem with most “academic flumes” is that they are normally designed to investigate one process such as sediment entrainment or stratigraphic relationships following deposition. This study investigated different flume designs and constructed one suitable for multiple duties at reasonable cost (less than \$700.00), and using easily obtainable materials. The flume is capable of generating a variable water current up to 50 cm/s through a 16 cm wide, 230 cm long spillway. This part of the flume is used to monitor sediment motion in various current regimes. A large depositional box, 60 cm wide and 90 cm long, at the end of the spillway is used to monitor depositional processes, and is particularly useful for sequence stratigraphic reconstructions. The entire flume assembly is built on a solid platform that can be tilted up to 15° to imitate different erosional gradients. The substrate in the depositional box can be independently tilted to imitate different depositional situations (e.g., continental shelf versus continental slope). The next step in the study is to establish the operational and modeling limits of the flume. This will be done by running a series of experiments using different geological materials at different operating parameters (current, slope etc.).

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**Using Molecular Techniques to Assess Population Genetic Structure of
Illicium parviflorum, a Rare Florida Endemic Shrub**

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Illicium parviflorum, a small, rare evergreen shrub endemic to Central Florida, is considered endangered by the Florida Department of Agriculture and Consumer Services. Previous studies have suggested clonal growth is the primary form of reproduction in this species, resulting in implications of limited genetic diversity occurring both within and among populations. Our objective was to use molecular techniques to assess clonal structure and genetic variation within and among different populations of *Illicium parviflorum*. Six sites were sampled across a range of *I. parviflorum*. A polymerase chain reaction (PCR) based assay using inter-simple sequence repeats (ISSRS) was used to amplify specific regions of DNA within each population. The DNA fragments were separated using gel electrophoresis and visualized using Kodak Software. Completion of data analysis will denote genetic variability and provide a better understanding of the reproductive ecology of *I. parviflorum* to allow for the preservation of biodiversity and a foundation for the conservation of the species.

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Geological Mapping And Cross Section Of The Bounds Lake, Alabama, 7.5' Quadrangle

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A map of the Bounds Lake area in the southernmost Appalachians of Alabama is presented through the creation of a geologic map and cross section. This geologic map and cross section are special tools geologists use to display the information about the structure and stratigraphy on the surface of the earth. It shows the location of different types of geologic hazards, such as faulting, and the different types of minerals and resources, such as ore deposits. The most important feature of the geologic map and cross section is the ability to show data representation of the rocks in a three dimensional view. This is important for understanding where the earth resources and characteristics are located and when these features on the earth were formed. The geologist being able to understand and interpret this geologic map and cross section will aid them to apply their understanding in solving problems related to earth resources, hazard assessment, and land-use planning.

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Statistical Analysis of NFL Point Spreads

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Gambling is the wagering of money or material possession on the outcome of an event with the hope of winning more money or possessions. There are many different types of gambling, including sports betting. This research highlights the popular activity of gambling on the National Football League (NFL). Regression analysis is used to predict the value of a dependent variable based on the value of at least one independent variable. First, a correlation is used to determine if there is a relationship between two variables. Data is entered and analyzed through a data analysis medium, such as Microsoft Excel. These results give a number that is between -1 and 1. Each statistical analysis has a null and alternative hypothesis. This research was trying to determine whether betting point spreads could be used to predict the outcomes of NFL events. The null hypothesis is: point spreads can be used to predict the outcome of NFL games and the alternative hypothesis is the opposite of the null. Data was collected from the 2005-2007 NFL football seasons and entered into Microsoft Excel. This data was entered into the following Linear Regression formula: predicted outcome of event = intercept coefficient + variable coefficient (predictive variable). Using the data from the spreadsheet an example of the usefulness of the equation is as follows: During the week 1, game 1, of the 2005 NFL season the New England Patriots played the Oakland Raiders. The predicted spread was -7.5 in favor of New England and the actual outcome was -10 (New England victory by ten). Using the actual spread coefficient the predicted point spread is used to prove if point spreads can be used for predicting outcomes using the derived equation above: $-5.254 + .0655(-7.5) = -5.74525$ If the actual spread coefficient found from the data was used for this game in 2005 and the gambler took the underdog, the gambler would have lost his bet by -2.5 points. According to the findings of the data, the current conclusion is made to reject the null hypothesis and state that this formula cannot be used to predict outcomes of NFL games. Further analysis will be conducted to come to a solid conclusion about predicting actual point spreads with predicted point spreads.

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Decision-Making among Caregivers of Patients with Heart Failure

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The purposes of this qualitative study are to describe decision-making process among caregivers of patients with heart failure and to examine the impact on caregivers' health that caregiving makes. In this present study, the data from nine participants were included, and the grounded theory was employed for qualitative analysis. The findings showed that caregivers were making various kinds of decisions from medications for care recipients to their own health. Many participants mentioned their decisions regarding medications and financial management, which implied that those two were the main concerns for those caregivers. Analysis of the collected data suggested that tremendous number of factors influenced decision-making process for caregivers. The main factors were; knowledge of medicine, relationship between caregivers and care recipients, relationship with healthcare providers, financial status, responsibility of being in role of decision maker, fear of making wrong decisions, presence or absence of support, and spiritual beliefs. The importance of each factor depended on each caregiver. About the caregivers' health, the data revealed that caregivers tended to neglect their own health. There was some noticeable influence to caregivers' health, but they were not likely to pay much attention to it. One of the prospective expectations of this study is to improve healthcare providers' understanding of caregivers' situation and decision-making process. Furthermore, the findings in this study are expected to help health professions to assist patients and their caregivers to improve their physical and mental health more efficiently with holistic view.

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Analysis of Cancer Stem Cell-Associated Proteins by Western Blotting

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Research of stem cells has been a great breakthrough in the medical field. Recently, the discovery of cancer stem cells has also given new insight on remedies for cancer patients. In a growing fetus and during childhood, stem cells produce differentiated cells for all tissues of the human body; from organs, to brain cells, to bone and skin. The discovery of the cancer stem cell shows that these progenitor cells show the same characteristics of self-renewal and the ability to form many cell layers. The cause of these cancer stem cells growing inside of tumors is still unknown. Just as there are numerous types of cancers, there are numerous types of cancer stem cells. The research Dr. Lorico and Dr. Germana Rappa are pursuing will lead to identification techniques further developing the knowledge of the complexity of each cancer stem cell. Cultures are grown, separated and tested with different antibodies to show which antigen will reflect the cancer stem cell through a technique called Western Blotting. Some antibodies have proved effective while others give no information. Research will continue testing each stem cell for differences and patterns of growth. Finding pathways and understanding their inner network will allow researchers to take a different approach to cancer treatment and will also decrease recurrence after remission.

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Fuel Cell Systems and Renewable Energies

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With the rapid depletion of fossil fuels and the current economic state, it is necessary to investigate alternative energy sources such as wind, solar, and hydrogen-electric power. To bring this focus of study to the University of South Alabama, three fuel cell systems have been constructed that will demonstrate the basic principles of a Proton Exchange Membrane (PEM) Fuel Cell, in addition to PEM electrolysis powered by solar and wind energies. Experiments were conducted with each system showing how the Fuel Cells were affected when subject to various electric loads. Two of the systems come with computer software to aid in the analysis of the fuel cell as well as the construction of characteristic curves for each cell stack. The construction of these fuel cell systems is intended to provide students in the chemical engineering department with hands on experimentation and basic characterization of PEM fuel cells, as well as promote focus on environmentally-safe, economic energy.

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Navigation Simulation for a Robotic Tour Guide

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The Computer and Information Sciences (CIS) department of the University of South Alabama (USA) cooperated with the University's Engineering department to create a human-sized tour guide robot named Veronica. Veronica's primary purpose is to aid those new to campus by introducing the major buildings that will be of value to them as academic and recreational landmarks. Not only does it show new students and visitors a fixed route around the University of South Alabama, but it will also interact using speech and gestures, be capable of impromptu changes to the tour route in response to tourists' wishes, and thus generally showcase the current technology. The focus of this portion of the project rests in the mapping system used by Veronica to navigate all the major sites of the tour, though there are three other major parts to the robot. These include the fundamental navigation portion CIS is responsible for, the speech system that provides recognition and generation of human speech, and the physical construction of the robot within the Engineering department. The graphics and simulation team created a map on paper of a single route, which circles the main campus with help from the JagTran. After finalizing the paper maps, they were converted into a C# simulation that shows the current location of Veronica. The project as a whole is not finished yet, but a lot of progress has been made and there are no obstacles to completion. The next benchmarks will be to create alternate routes after testing the combined system around the CIS and the Engineering complexes. With built-in remote control, Veronica Jagbot will be a versatile, entertaining, and very important member of both the Computer and Information Sciences and Engineering Departments.

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**Beryllium (II) Complexation Trends with Hydroxy Keto Heterocycles:
Examination via Mass Spectrometry**

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Four hydroxyl keto heterocycles (kojic acid (ka), maltol (ma) n-methyl maltol (nmm), and n-methyl kojic acid (nmk)) were tested as chelating agents to beryllium (II) and observed in ion trap mass spectrometry. Each heterocycle complexed with beryllium to yield $[\text{BeL}_2\text{H}]^+$, $[\text{BeL}_3\text{H}_2]^+$, and $[\text{Be}_2\text{L}_3]^+$, where L is the deprotonated heterocycle. During tandem mass spectral fragmentation of the complexes, the collision energies were recorded, yielding rough estimates on the relative stabilities of the complexes. These estimates show that maltol binds far more to Be(II) than kojic acid, which is similar to a trend previously established in the literature.

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The Effects of Speech Rates Based Upon Acceptability and Intelligibility of Dysarthric Speech

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Speakers with dysarthria have reduced speech rates, monopitch, monoloudness and poor articulation. For clinical evaluation, audio recordings typically are made with head-mounted microphones that eliminate normal reverberation. Reverberation, similar to an echo, generally helps the perception of speech. Thus these recordings may not represent typical speech performance. Speech recordings made in quiet of four speakers with dysarthria and two controls were used to create sentence stimuli under three reverberant conditions: minimal, typical, and excessive. Thirty normal listeners rated recording for acceptability (via 5 point scale from "terrible" to "excellent") and intelligibility (percent correct words identified). For acceptability, impaired speakers were each rated differently, but ratings did not differ across reverberant conditions for each individual. For intelligibility, scores were distinct for each speaker across reverberant conditions. The best and worst speakers showed ceiling and floor effects, respectively, across reverberant conditions. Scores for the two mid-ranged speakers showed significant differences across reverberant conditions. Both received the best scores for the minimal reverberant condition. The objective nature of the intelligibility ratings did not match the subjective nature of acceptability ratings. Further, recordings made with head mounted microphones that reduce reverberation appeared to result in the best intelligibility ratings for these impaired speakers. This supports the continued clinical evaluation of these patients using head mounted microphones when assessing speech production abilities. These evaluations may not be appropriate for evaluating their effectiveness in natural environments.

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JagBot Navigation Simulation

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The goal of the overall project is to create a tour guide robot that can give tours of campus to new and incoming students and will hopefully attract students to the Engineering and Computer and Information Science fields. This is, of course, a large task that involves many different subtasks. For this reason the task has been split into many smaller tasks each of which has a group working to complete that task. The part of the project with which I am closely involved is a simulation of the robots ability to follow a path and give a tour while doing so. I am working on this section of the project with Jenny Plott, another Computer Science student.

The simulated routes will be useful when the actual robot begins to move as a “you are here” visualization of the path being traversed. In the process of this work it was recognized where the robot would need to go and what paths it would follow to reach these locations. The robot should not leave the sidewalks and cannot traverse stairs or any such obstacles. It was decided that the robot would need to visit the CIS compound, the Administration building, the Mitchell Center, the Bookstore/Student Center area, and the Engineering compound. We first needed to acquire maps of the parts of campus through which the robot would need to travel. Once we had obtained/created the necessary maps, we plotted paths and important points for the robot to move through or stop at throughout these areas. This also involved walking the paths to check for obstacles that could become problems for the robot. Along each path a variety of points were defined: location points, waypoints, speaking points, and decision points. Eventually when the robot reaches one of these points, as realized by the GPS data, the appropriate actions would take place. A graphical simulation has been successful implemented in C# and further work will continue the remainder of the year. The focus of the simulation was the underlying data structure. We created a linked list of points that could be traversed in either direction, with each decision point having a list of points to which it is directly connected. To handle the different types of points, inheritance from a basic point class was used to create classes for the necessary types. This was an excellent learning project which allowed me to incorporate many core CS course concepts especially from data structures.

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<p>Odonate Larvae in Seasonally Poned Isolated Wetlands in the Grand Bay Pine Savannah</p>
<p>Rachel Ruttley, Kristin Wilkinson, C. Smoot Major, and John McCreadie</p> <p>Department of Biology, College of Arts and Sciences, University of South Alabama</p>
<p>It is believed that the distribution of species is nonrandom and is predictable on the basis of Island Biogeography Theory (IBT). With this bio-inventory of Odonates found in the seasonally ponded isolated wetlands (SPIW's) of the Grand Bay Savannah biome we hope to establish the relationship between habitat (including vegetation) and Odonate fauna. Predatory insects, such as those in the family of Odonata, change habitats between larval and mature life stages. While in the immature stage, Odonate larvae require maximum growth rate potential from the niche while also minimizing death rate. Insects that show dispersal behaviors benefit from SPIW's (seasonally ponded isolated wetlands) by avoiding habitats with heavy risk of predation. Fish often are not present in these habitats due to the likelihood of SPIW's drying up seasonally. Very little is known about the significance and contribution of SPIW's to regional biodiversity. These habitats are often overlooked by virtue of their small size and have little protection due to lack of studies. This study is also beneficial in that we have identified species that use SPIW's that help control pest insect populations, such as mosquitoes.</p>

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Exploring the Relationship Between Folk Ascriptions of 'Intentionally' and 'Intend to' in Cases of Side Effects

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Recent empirical studies have shown that people are more willing to say that some agent Y produced some side effect X *intentionally* when the side effect involves moral considerations (e.g., see Knobe 2003). In a recent empirical study by Hugh McCann (2005), he found that people were more willing to attribute *intentionally x-ing* to an agent than they were willing to say that the agent *intended to x* in cases of side effects involving moral considerations. The purpose of the current study was to replicate and extend these findings with a larger sample size and through the use of a 7-point Likert scale in which respondents could express how much they were willing to attribute *intentionally x-ing* and *intend to x*, instead of simply relying on dichotomous *yes* or *no* answers. Three major predictions were made: (1) Respondents would be more willing to attribute *intentionally x-ing* and *intend to x* in cases of side effects involving moral considerations when compared to cases of side effects without moral considerations. (2) Respondents would be less likely to attribute *intend to x* than *intentionally x-ing* in cases of side effects involving moral considerations. (3) The asymmetry between attributions of *intend to x* and *intentionally x-ing* in cases of side effects involving moral considerations would be less pronounced when *intend to* questions were asked first. To test these predictions, a 2 (intend to questions versus intentionally questions) x 2 (side effects without moral considerations versus side effects with moral considerations) x 2 (intend to questions asked first versus intentionally questions asked first) design was implemented. The first two conditions were given within subjects. The order condition was given between subjects. A mixed-design ANOVA reported significant main effects and significant interaction effects where the hypothesis predicted they would occur. Thus, the current study found that respondents were more willing to attribute *intend to x/intentionally x-ing* in the moral consideration condition, were more willing to attribute *intentionally x-ing* than *intend to x*, but that the difference between attribution of *intentionally x-ing* and *intend to x* in the moral consideration conditions disappeared when the *intend to* questions were asked first.

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Synthesis of Pro-drug Candidates by “Click” Chemistry

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Click chemistry has been widely applied to bioorganic and medicinal research fields because of its highly efficient reactions to synthesis a variety of new compounds quickly under mild conditions. The reaction provides 1,4-linked-1,2,3-triazole derivatives regioselectively. Other researchers have shown that some prodrugs containing the 1,2,3-triazole linkage exhibit biological inhibitory activity. The reactions between benzyl kojic acid azide and various terminal alkynes were performed to cleanly synthesize triazoles, catalyzed by copper salts. The overall percentage yields of these reactions ranged from 58.5% → >99.5 %. The use of click chemistry quickly assembles various interesting molecules with high yields and with a variety of starting materials. These “near- perfect” reactions will aid to accelerate the discovery of better and cheaper drug substances. In future work, these pro-drug targets will be screened for biological activity, both against methicillin-resistant *Staphylococcus aureus* (MRSA), and as an inhibitor of tyrosinase activity.

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Effect of Shear-Stress on Krüppel-Like Factor 2 Expression by Rat Pulmonary Microvascular Endothelial Cells

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Purpose: Krüppel-Like Factor 2 (KLF2) is a subclass of the zinc finger family of DNA-binding transcription factors. KLF2 has many roles in physiological regulation such as being antithrombotic, antiatherosclerotic, antiproliferative, and vasodilatory. KLF2 is poorly expressed in arterial branchpoints and curvatures and is up-regulated with shear-stress in systemic vascular endothelial cells. KLF2, also known as lung KLF, is highly expressed in the lung. The pulmonary arteries do not develop atherosclerotic plaques as opposed to the systemic arteries. The high KLF2 levels in the lung might contribute to the atherosclerosis of pulmonary arteries. Regulation of KLF2 in pulmonary endothelial cells has not been addressed. We hypothesized that KLF2 in pulmonary microvascular endothelial cells will be upregulated with shear-stress.

Methods: Microvascular endothelial cells were cultured under 15 dynes/cm² of shear-stress in an artificial capillary system for 3 and 6 hours. Whole cell lysate of statically cultured and flow-adapted cells were prepared. Western analysis was used with polyclonal anti-mouse KLF2. Western analysis was used to determine KLF2 bands. Primary antibody was a polyclonal goat anti-mouse KLF2 and the secondary antibody was a horseradish peroxidase (HRP) conjugated anti-goat IgG. Glyceraldehyde-3-Phosphate Dehydrogenase (GAPDH) was used as a loading control and visualized with a rabbit anti-GAPDH and a donkey anti-rabbit alkaline phosphatase (AP) conjugated secondary antibody. Chemiluminescence substrate was used to detect AP and HRP antibodies. Digital pictures of KLF2 bands were captured and optical density of bands were analyzed with Quantity One software. Band density data was normalized to GAPDH and plotted using SigmaPlot software.

Results: KLF2 is up-regulated in rat PMVEC with 6 hours of flow adaptation at 15 dynes/cm² compared with statically cultured cells.

Conclusions: Up-regulation of KLF2 with flow adaptation suggest its potential role in endothelial cell response to shear-stress.

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Modeling The Electrical Activity of the Heart

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Modeling the electrical activity of the heart can be accomplished by representing major components of the heart using systems of differential equations and solving these systems numerically. The components considered are the sino-atrial node, the atrio-ventricular node, Purkinje fibers and the ventricular myocardial cells. Each component is modeled as a system of differential equations and the couplings are represented by simple resistive currents. *MATLAB* is used to numerically solve the models for individual cells and for coupled components of the heart. Voltage versus time graphs are plotted for each component and these are seen to closely resemble experimentally obtained plots of *in vitro* cardiac cells.

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Impacts of Environmental Variation and Non-native Species on Aquatic Plant Communities in the Weeks Bay National Estuarine Research Reserve

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A long-term study was initiated during the summer of 2008 in the Weeks Bay National Estuarine Research Reserve (WBNERR), Baldwin County, Alabama. Weeks Bay is a small estuary (8 km²), receiving freshwater from the Fish and Magnolia Rivers, and is characterized by a diversity of vegetation types (e.g., uplands, wetlands, and submerged aquatics). Thus, the WBNERR is an ideal place to conduct plant biological and ecological research. The overarching goal for this study is to observe the long-term changes in submerged aquatic vegetation through physiological and ecological investigations into native and non-native plant interactions. The specific objectives for this portion of the project were to: 1) identify and set up eight long-term sampling sites, 2) establish a bi-monthly sampling plan, and 3) learn protocols for effectively measuring environmental parameters (e.g., temperature, light, pH, salinity, and nutrient concentrations) and percent plant cover for various native (e.g., *Vallisneria*, *Ruppia*, *Ceratophyllum*, *Najas*, and *Isoetes*) and non-native (e.g., *Hydrilla* and *Myriophyllum*) aquatic species. By the end of the project period (June through July 2008), eight 20 x 10 m transects were established with percent plant cover measured for each of five species in 12 plots (1 x 1 m) per transect. The vast majority of the 96 plots sampled were inhabited by *Vallisneria* and *Najas* (31 *cf.* 16 plots, respectively). To date, *Hydrilla* has been noted to only occur in Barner Branch and, fortunately, does not appear to be spreading out from this site. To our knowledge, this will be the first long-term study designed to investigate native/non-native plant interactions and their impact on aquatic plant community structure in the WBNERR.

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Synthesis of Diels-Alder adducts as PP5 inhibitors

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Several Diels-Alder reaction adducts were prepared in an effort to test various formats of the 7-oxabicyclo[2.2.1]heptane molecular scaffold for their inhibition activity against the protein phosphatase enzyme PP5. The goal of these and future experiments is the development of a small molecule capable of PP5 inhibition at low toxicity for application in chemotherapy treatments. Seven compounds were prepared using the Diels-Alder reaction as the key step and six of these compounds were submitted to the USA College of Medicine for testing.

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Effects of Emotional Expression on Audiovisual Speech Perception

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Observing the movement of the mouth while someone is speaking has often been found to aid a listener in speech detection and comprehension. However, the accessibility of visual speech is altered by facial expressions, which can cause some distortion of the facial configuration and may add emotional content to the signal. To test the influence of emotional content on audiovisual speech comprehension, audiovisual sentences were presented in a random mixture of happy, sad, and neutral emotional conditions. All sentences were semantically neutral and presented in a 12-talker background babble (i.e., 12-talkers producing speech concurrently with no semantic or grammatical context). After each sentence presentation, participants responded by repeating what they heard. Emotional content was found to influence comprehension, in that participants had higher rates of comprehension in the happy, than neutral or sad conditions. Hence, while emotional expression did not seem to distort visual speech, happy expressions may have encouraged an approach response from participants.

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Skin Temperature Increase during MMW Irradiation; Effects of Blood Flow

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Electromagnetic energy of radio frequency (RF) is known to cause tissue heating. For radiation in the millimeter wave band (MMW; 30 GHz-300 GHz) the energy absorption is very superficial. At these frequencies, most of the energy is absorbed within the first 0.5mm of tissue. Human exposure to MMW radiation can come from diverse sources, including automotive collision avoidance radar, and certain non-lethal weapons. There also are numerous potential medical applications employing MMW technology, such as removal of dental carries and atherosclerotic plaque ablation.

The purpose of this work is to assess the feasibility of using MMW heating and non-contact thermometry to measure the rate of blood flow to the skin. This technology could have significant clinical and research applications such as characterization of peripheral circulation in the management of Diabetes Mellitus. We hypothesize the rate of temperature increase of the skin surface during MMW exposure is affected by (1) the rate of the energy absorption in the skin and (2) temperature and rate of blood flow to the tissue. We have developed an in vivo experimental method to model the effect of skin blood flow on skin surface temperature increase using a rabbit ear preparation and a low-power, 35 GHz MMW transmitter. Surface temperatures are measured during exposures using a non-contact infrared (IR) thermography camera. Preliminary results show that skin surface temperature increases of up to 15 °C are achieved in specimens exposed for three minutes with occluded auricular arteries, no blood flow to the ear. The rate of temperature change is decreased at a full blood flow condition.

Future experiments in concert with a modeling effort will be directed at developing a detailed understanding of the relationship between MMW irradiation, skin blood flow and temperature increases. The results may be useful in the development of a novel method for non-contact measurement of skin blood flow rates.

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Special Section: Summer Pipeline Program to Reduce Health Disparities: Introducing High School Scholars to Health Care Research

Most Frequent Ambulatory Care Sensitive Conditions Among Patients Admitted to the USA Medical Center, 2004-2007

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Ambulatory Care Sensitive Conditions (ACSC) are conditions in which potentially fatal diseases and hospitalization can be prevented by seeking primary care. Factors include low income, minority race, poor access to primary care services, insurance coverage, lack of regular source of care, and poor education. Hospitalizations for ACSC can be used to evaluate the status of primary healthcare of the community by indicating areas with poor access to healthcare. We studied the four year rates of hospitalization for ACSC at the University of South Alabama Medical Center (USAMC), a tertiary care teaching hospital in Mobile, AL. Data collected included demographics, risk of mortality, ICU days, length of hospital stay, and charges. We hypothesized that there would be little change in ACSC diagnoses throughout the four year period. Discharge records from the USAMC were sorted and analyzed using the Statistical Analysis Software (SAS) program. Results show that the most frequent ACSC are Congestive Heart Failure (CHF) (26%-38%), Bacterial Pneumonia (17%-23%) and Uncontrolled Diabetes (18%-21%). The majority of patients admitted for these ACSC reside in the immediate service area of USAMC, a predominantly African American, low income, medically underserved area. Though results show that there is a slight decrease in admissions for CHF and diabetes, a slight increase in admissions for pneumonia was observed over the four year study period. Further study is required to understand the relationship between the trend observed and access to primary care.

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Delivering Messages about Obesity to Women through Email Networks

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Community Health Advocates at the University of South Alabama Center of Excellence are concerned about women's health. Women often pay more attention to their family's health and forget about their own (Minkler & Roe 1993) and may put their health at risk for diabetes, hypertension, sleep apnea, many cancers, stroke, cardiovascular disease and overall mortality (Mark Hamler 2006). Obesity has become an increasingly serious issue around the world especially in women (Hensrud & Klein October 2006).

This project sent a health message sent to 20 women, family, and friends, aged 19 and older. Each woman forwarded the message to at least 2 women. Women were asked to respond to the sender to evaluate the usefulness of the message. Data included: number who got the message and number who responded. Materials included a working email address and a computer.

Of the 20 initial recipients of the message, only 9 replied to report what they thought about the information. Out of the 9 that replied only 4 forwarded the message. I received responses from 16 women. Respondents were family and friends of the women who received the first round of emails. I expected to get a higher response rate among older women, while getting the attention of the younger women. Email is an effective way for messages to spread within social networks; however, success was limited in this pilot project. In the future, I plan to try other strategies to get health information out to women, using their social networks.

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Pattern of Admissions for Ambulatory Care-Sensitive Conditions: USA Medical Center, 2004-2007

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Ambulatory Care Sensitive Conditions (ACSC) are conditions where good outpatient care can prevent the need for hospitalization, and where primary healthcare can prevent complications or increased severity of diseases. The objective of this study was to quantify how many patients were hospitalized at the University of South Alabama Medical Center (USAMC) for ACSC during a four year period (2004-2007), thus providing an indication of the availability of primary healthcare in the area. We hypothesized that only small variations in the rates of hospitalization throughout that period will occur. The data used was taken from the discharge records at USAMC. It included the demographics of patients with ACSC. It also showed the risks of mortality, ICU days, and length of hospital stay for patients. Data were analyzed for patients in the hospital's immediate and greater service area. A downward trend in hospitalizations for ACSC from 2004 to 2007 was observed; however, this was parallel to a decline in the population in the immediate service area. Most frequent ACSC causing hospitalization were congestive heart failure, diabetes and pneumonia. Between 13 to 22% of patients spent at least one day in the Intensive Care Unit, and the majority of patients spent one to two days in the hospital and sustained charges between \$3,000 – \$10,000. Data on patients who should have received preventable care and the costs of their treatments will help stress the importance of having adequate access to primary care physicians in the area.

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Electronic Aggression as a New Form of Violence in the Home: Radio Rap Sessions to Raise Awareness in Parents and Youth

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Community Health Advocates have recently paid close attention to the rapid increase of youth violence in local communities today. Karen Townsend Carson, author of "Poverty and Youth," further back-up the Community Health Advocates when she states, "Violence exposure among rural youth is a significant public health problem, yet little research has been conducted on violence in this setting." The Centers for Disease Control and Prevention recently released a podcast on a new type of youth violence in the home setting – "electronic aggression" (CDC Podcast 2008). The CDC reported that up to 34% of youth say they been victims of electronic aggression and as many as 21% report having committed this type of violence.

This pilot project will work with a local radio station to produce an on air rap session open to any caller, on the topic of electronic aggression as an emerging form of violence in the home. The rap session will deliver one question for parents and another for youth. The radio commentator will ask young people and parents to call in. I will take notes on caller comments and ages. In my research, I plan to increase youths' and parents' awareness of electronic aggression; and most importantly what can be done in the home to prevent this kind of violence.

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Addressing Health Disparities Using Photovoice

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Health disparities research is strengthened by community-based participatory research methods. Photovoice is a participatory research method that uses photography to bring about social change. Photovoice allows people to use visual evidence to articulate their problems and possible solutions. The objective of this project was to determine retrospectively if there are intergenerational differences with regards to perceptions of factors impacting community health. Methods: We examined pictures and logs of photovoice participants from three age groups: senior citizens, working-age adults, and school-age children. Participants were from underserved African American communities and had been instructed to identify important health related problems in their community, develop themes for taking pictures, and take pictures depicting these themes. Photos were reviewed and separated into themes. Results: Themes that emerged as factors impacting community health were vacant housing, trash in inappropriate places, unattended and unkempt lots, abandoned vehicles, and street problems. The unattended and unkempt lots were thought to be more of a problem among the senior citizen and adult group when compared to school-age children. The highest percentage of children's photos was vacant housing. Logs and notes from project discussions gave insight regarding how participants thought of these themes as health factors. In general, concerns for safety and lack of opportunity for physical activity were common to all groups. Perceptions of factors impacting community health were not significantly different across generations in the African American communities. Solutions to these problems should be perceived positively by all community members.

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