ABSTRACTS OF PAPERS, 88th Annual Meeting of the Virginia Academy of Science, May 20 - 21, 2010, James Madison University Harrisonburg, VA

Aeronautical and Aerospace Sciences

TRACING THE GROWTH OF THE U.S. NAVY AVIATION. M. Leroy Spearman. Langley Research Center, Hampton, VA & Robert W. Heath, RRMC, Newport News, VA. The Navy's first interest in aviation may have occurred in March 1898. Assistant Secretary of the Navy, Theodore Roosevelt, impressed by Samuel P. Langley's success with flying models, reported the potential of aviation for use in war. A joint board (Navy & Army) was appointed to consider the role of aircraft in warfare. The board's report expressed a view in favor of aviation for military purposes. The Navy did acknowledge a role for aviation in September 1910 when Capt. Washington I. Chambers was designated as the officer in charge of aviation matters. Soon Glenn Curtiss, a U.S. pioneer in aviation, began meeting with Chambers in an effort to convince the Navy of the value of aircraft for Naval use. In November 1910 Eugene Ely took off in a Curtiss airplane from a wooden platform built over the bow of a ship in the harbor at Hampton Roads, VA. In 1921 the Army Air Service conducted bombing tests in which bombers sank a captured German battleship. The Navy recognized the need for fleet defense and expanded the development of aircraft carriers. In March 1922 at Norfolk, VA, the Navy commissioned the USS Langley (CV-1), the first aircraft carrier, on which the first take off and landing and the first catapult launching were made. In 1933 the first ship designed as an aircraft carrier, the USS Ranger (CV-4), was launched at the Newport News ship yard. Since then, 28 aircraft carriers have been constructed for the Navy at that shipyard and Navy aviation was well underway.

SOME CONTRIBUTIONS TO AERODYNAMIC RESEARCH FROM THE NACA/NASA. M. Leroy Spearman. NASA-Langley Research Center. Hampton, VA & Katie Klein, MITRE Corp. McLean, VA Leonardo da Vinci envisioned man-flight in the 15th century and designed a practical airplane concept in 1490. Many other pioneers proposed various types of flying machines over the next 400 years but it was not until!903 that the Wright Brothers, were credited with achieving the first manned-powered flight. The use of aircraft by European nations in World War I lead to an act of the U.S. Congress in 1915 that established the National Advisory Committee for Aeronautics (NACA). Thus research began at Langley Field, VA in the early 1920's. This research has transformed low-speed, wood and fabric, propeller-driven airplanes into high speed, all-metal, jet-propelled airplanes. In July 1955 the U.S. announced plans to launch an earth-orbiting satellite. The need for space research lead to the establishment of the National Aeronautics and Space Administration (NASA) in July 1958. The nucleus of the NASA was the existing NACA with the charge expanded to include space research. The skilled researchers at NASA-Langley have continued to provide improvements in aircraft

developments and contribute to the development of spaceflight as well. Continued advances in aerospace research required well trained researchers. To this end, NASA-Langley participates in mentorship programs to encourage high school students to become researchers. The first author of this paper has been a mentor for this program and the second author of this paper has been a student.

FEDERAL FUNDING OF AERODYNAMIC RESEARCH IN THE UNITED STATES. M. Leroy Spearman, NASA-Langley Research Center, Hampton, VA 23681. In 1898 the Assistant Secretary of the Navy, Theodore Roosevelt reported to the Secretary of the Navy of the potential of aviation for use in war. A joint board was appointed (Army & Navy) to consider the role of aircraft in warfare. In April 1898 the Board's report favored the value of aviation for military purposes. In 1910 Capt Washington I. Chambers was designated officer in charge of Navy aviation matters. The Navy constructed an Experimental Model Basin . In 1912, at the urging of Capt. Chambers, President Taft appointed a board to consider a national aerodynamic laboratory. Legislation to create the laboratory was introduced in Congress in 1913 but was defeated. When war broke out in Europe in 1914 it was apparent that European countries had adapted the airplane and that development in the U.S. was lagging. Charles D. Walcott of the Smithsonian Institute undertook the effort to get approval for a federally funded aerodynamics laboratory. In January 1915, Assistant Secretary of the Navy, Franklin D. Roosevelt endorsed a resolution introduced in Congress for the creation of an advisory committee for aeronautics and suggested that it be attached to the Navel Appropriations Bill. The bill was approved on March 3, 1915. President Woodrow Wilson signed a bill that established the National Advisory Committee for Aeronautics (NACA), now the National Aeronautics and Space Administration (NASA), that provides federally funded research for aeronautics and astronautics.

Agriculture, Forestry and Aquaculture Science

EFFECTS OF DIFFERENT ORGANIC APPLICANTS ON SOIL CONDITIONS FOR BLUEBERRY PRODUCTION. Jeremiah D. Vallotton & Roman J. Miller, Dept. of Biology, E. Mennonite University, Harrisonburg VA, 22802. Blueberries are a potentially profitable crop that have yet to be tested under organic agricultural practices in the Shenandoah Valley of Virginia. Blueberries require a low pH between 4.8 to 5.5 and high levels of organic matter for optimal growth. In this experiment, four treatments of organic matter (horse manure, sheep manure, pine needles, and compost) were used to grow blueberries, along with a control plot where chemical herbicides and pesticides will be used. Elemental sulfur was used on all plots to lower the pH of the soil over time. Soils were sampled and analyzed to measure soil pH, soil organic matter, and nutrients. Tests suggest that the organic treatments had a highly positive effect on the soil organic matter levels, while decreasing the pH yielded higher levels of available Mn and Fe, but Cu remained low. Soil pH mostly decreased to desirable ranges, but in some of the plots application of sulfur resulted in less change. The most recent tests indicate that the pH continued to decrease, from an average of 6.1 to 5.5,

though the manure treatments were still somewhat high. Organic matter increased by 19%. Organic amendments provide excellent conditions for successful organic production of blueberries. (Research supported in part by USDA Specialty Crop Grant # 2008-427, Commonwealth of Virginia, Department of Agriculture and Consumer Services.)

ACTH 22-39 INDUCES HYPERPHAGIA AND ANXIO-LIKE BEHAVIORS IN COBB-500 CHICKS. Caitlin A. Reid, Evin L. Guilliams, and Marissa L. Smith. Dept. of Biol., Radford University, Radford, VA 24141. The melanocortin system plays a key role in the regulation of appetite in both mammals and birds. A member of this system, ACTH 22-39, is cleaved from proopiomelanocortin and is a well known insulin secretagogue. However, it also increases food intake in mammals. To our knowledge its effects are unreported in avians. When centrally administered, ACTH 22-39 (0, 2, 4, 8 nmol) increased food intake in fed 4-day post hatch Cobb-500 chicks but did not affect whole blood glucose concentrations. That ACTH 22-39 is an insulin secretagogue and food intake increases glucose may explain this lack of a net effect on glucose concentrations. To determine if food intake was competitive with other behaviors a 60 min behavioral analysis was conducted which revealed that ACTH 22-39 also increases the number of jumps and escape attempts. Other behaviors were not affected. These data may lead to novel treatments for anorexia in other species, including humans.

COMPARATIVE GENOMICS ANALYSIS OF GENETIC FACTORS INFLUENCING RESISTANCE TO GASTROINTESTINAL PARASITES. Damarius Fleming & Glenn C. Harris, Dept. of Biology, Virginia State University, Petersburg, VA 23806. Gastrointestinal (GI) parasite infections are a primary limitation to livestock production. As nematode resistance to anthelmintics continues to spread worldwide the search for factors that confer genetic resistance gains new importance. We use a mouse model as a framework for comparative genomic mapping with cow, rat, chicken and human to identify the genetic factors associated with phenotypes that are resistant to GI infections. A total of 10 regions in mice were matched with syntenic regions in the other species and an accumulated list of candidate genes was assembled and prioritized. Most candidate genes identified have a function involving cytokine function or intestinal immune regulation. These results confirm that GI nematode response is multifactorial, potentially including the interaction of many genes, and provide a list of prioritized gene candidates that represent prime targets for individualized functional analysis in future studies.

DEVELOPMENT OF DNA PROBES FOR DETERMINATION OF SPECIES IN MIXED POPULATIONS. Tiffany Toledo and Brian L. Sayre, Dept. of Biol., Virginia State Univ., Petersburg, VA 23806. A quick reliable test to determine the species of organisms found in environmental samples has far reaching potential. An example may be to determine the source of contamination in a ground water location during a disease outbreak. We are developing a technique to use DNA for determination of individual species in a mixed species environment. The objective of this experiment was to

develop a DNA probe for use in this technique. The DNA of mixed plant samples was amplified using PCR with primers developed for the NADH dehydrogenase subunit 5 gene of the mitochondrial DNA. The PCR product was attached to an Au nanoparticle and DNA binding determined with spectrophotometric anlayses. Ultimately, these nanoparticle-DNA probes will be used to create a detection system that will have increase sensitivity and capability to detect DNA from multiple organisms in an environmental population.

HOW TEMPERATURE AND LIGHT AFFECT TOMATO YIELD IN WINTER-SPRING GREENHOUSE PRODUCTION. Mark E. Kraemer and Françoise Favi, Agricultural Research Station, Virginia State University, Petersburg, Virginia 23806. Rising energy costs have been a significant factor in winter-grown greenhouse tomato production. Propane prices generally track the cost of oil. It was proposed that reducing temperatures in the greenhouse during periods of cloudy weather could reduce costs with little to no loss in tomato production. Previous research indicated that under low light conditions (PAR<100μE) the photosynthetic rate of variety Trust leaves, the most commonly grown greenhouse tomato used in the mid-Atlantic region, was not significantly different at 64°F than at 74°F. In this research, two sections of a glass greenhouse were used to compare tomato yield under different temperatures. Daytime temperatures in the west section were set to 74°F whereas east section was set to 64°F, before fans would come on. Night temperatures were the same in both sections (60°F). The overall difference in temperature between the two sections was 2.3°F. After 8 weeks, the warm section yielded 27% more ripe fruit than the cool room. However, the total weight of tomato fruit (harvested and green on the vine) was the same in the two sections. It appears that warmer temperatures do not increase tomato fruit biomass but promote fruit ripening. Because fruit biomass is not lost with cooler temperatures under low light conditions it may be possible to use temperature to time fruit production to market needs, or to save energy during periods of unusually cold weather.

INFLUENCE OF SHADOW COSTS OF FRESHWATER SHRIMP PROUCTION IN VIRGINIA. Brian Nerrie, Virginia Cooperative Extension, Virginia State Univ., Petersburg VA 23806. Consumers in the United States eat more shrimp than any other seafood. A great majority of shrimp are imported or harvested by domestic fishers in areas such as the Gulf of Mexico. Freshwater prawn (Macrobrachium rosenbergii) farming is presently expanding in Virginia. The prawn not only has established its own market, but has been shown to be an excellent substitute for marine shrimp. During 2009 prawn selling prices ranged from $15.40 – 22.00/kg. Production averaged between 500 – 1000 kg/ha and net returns ranged from $7700 – 22,000/ha. A producer association was subsidizing some input costs. Shadow costs, the maximum price a farmer is willing to pay for an extra unit of input, were examined for two major production inputs: sinking feed and juvenile shrimp. Feed cost ($0.66/kg) would have to increase by more than 100% to impact on the decision to produce. Juvenile shrimp costs would have to increase from $0.06/shrimp to more than $0.17/shrimp to discourage production.

USE OF WETLANDS TO REDUCE TROUT PRODUCTION EFFLUENT NUTRIENTS. Bryan Taliaferro & Brian Nerrie, Dept. of Agriculture, Virginia State Univ., Petersburg VA 23806. Wetlands are among the most productive ecosystems in the world that can filter nutrients, sediment, and pollutants from surface and ground water, absorb excess floodwater and rainwater, and provide habitats to numerous plants and animals. Constructed wetlands are engineered marshes that duplicate natural processes to cleanse water, process livestock effluent, human waste, and drainage water. With the worldwide demand for aquaculture products increasing, production of trout requires substantially high amounts of quality inflow water. This causes an increase in effluents that are discharged to the environment with enhanced nutrient and solid concentrations. Effluents contain significant amounts of organic and inorganic nutrients such as nitrogen and phosphate. Forms of nitrogen found are nitrogen – N_2, nitrate – NO_3, ammonium nitrogen – NH_4. Wetlands can be used as a cost-saving alternative treatment method that can combine both mechanical and biological effluent treatment. Wetland plants can be used for their ability to absorb nutrients through surface or sub-surface flow of water through the wetland. Certain plants can be found commonly around wetlands and make a greater contribution to the percent nutrient removal under low-load conditions than high-load. For wetlands that treat trout effluent with high loads of nitrogen (3.2 to 15.6g N $m^{-2}d^{-1}$) to wetlands with lower loads (0.4 to 2.0g N $m^{-2}d^{-1}$), plants assimilated on 1 to 4% of the nitrogen in the higher loads, as opposed to 18 to 30% of nitrogen in the lower loaded systems. This is significant in that with in a low load trout production, a constructed wetland of a particular size with the incorporated plants can reduce the amount of nitrogen released into the environment. In conclusion, wetlands can be a less expensive and more environmentally efficient method of removing nutrients from trout effluent as well as other sources if necessary.

A NEW PROPOSED STANDARD WEIGHT EQUATION DERIVED FROM HISTORICAL WEIGHT-LENGTH DATA TO CALCULATE RELATIVE WEIGHT OF CHANNEL CATFISH FINGERLINGS. Edward N. Sismour, Agricultural Research Station, Virginia State University, P.O. Box 9061, Petersburg, VA 23806. A standard weight (W_s) equation for calculation of relative weight (W_r = observed weight / W_s x 100) of channel catfish, *Ictalurus punctatus*, grown in aquaculture is proposed. The function, log W_s = -5.163 + 3.042 · log[total length (L_T, mm)], was derived using the RLP technique from nine weight-length relationships originally published as producer guidelines. It was compared to an equation published by Brown, Jaramillo, Gatlin, and Murphy (1995) for feral channel catfish and to Fulton's K using published mean weights-at-length of pond-raised catfish that received supplemental ration, observed weights-at-length of catfish grown in cages, and observed weights-at-length of feral catfish from the James and Rappahannock rivers, Virginia. $W_{s\,\text{<proposed>}}$ was ~50 percent higher at 7 cm and ~12 percent lower at 58 cm compared to $W_{s\,\text{<established>}}$. $W_{r\,\text{<proposed>}}$ increased linearly and $W_{r\,\text{<established>}}$ decreased nonlinearly with L_T for catfish receiving supplemental ration. Among cage-grown catfish, $W_{r\,\text{<proposed>}}$ and K showed no length-bias after three weeks. Among feral catfish, $W_{r\,\text{<proposed>}}$ showed no length-bias from 7 cm to 40 cm whereas $W_{r\,\text{<established>}}$ decreased and K increased with L_T. W_s predicted by the proposed equation for channel catfish from 7 cm to 40 cm and

W_s predicted by the equation of Brown et al. for channel catfish greater than 40 cm are suggested as a single reference guideline for channel catfish producers in lieu of the variable guidelines that are currently available.

TROUT GROWTH UNDER ALTERNATIVE FEEDING LEVELS. Terrone Jaspers & Brian Nerrie, Dept. of Agriculture, Virginia State Univ., Petersburg VA 23806. Rainbow trout (Oncorhynchus mykiss) is the primary cold water aquaculture species in Virginia. Four 7000-liter outdoor tanks were stocked with equal size (80 g) and number of trout (50) on 10 March. Water in the tanks was provided with diffused air from a centralized air pump. Each trout population was fed a 36% crude-protein floating pellet at a rate of 50, 100, 150 and 200 g/day. The study was terminated after 30 days. Water quality parameters were monitored in each tank. Alkalinity was 30 ppm with the pH ranging from 7.5-8.5. Ammonia levels were not detectable. Dissolve oxygen concentrations were consistently greater than 5 ppm. High temperatures (>22°C during the fourth week of the study resulted in the termination. Feed conversion ranged from 1.5 to 1.9. Average sizes of trout at harvest were: 98g (fed 50g); 111g (fed 100g); 128g (fed 150g); 160g (fed 200g.)

IDENTIFICATION OF CANDIDATES GENES FROM SHEEP QTL REGIONS USING A SYSTEMS BIOLOGY APPROACH. Brian L. Sayre, Dept. of Biol., Virginia State Univ., Petersburg, VA 23806. Variability in the genomic regions defined by QTL studies for parasite resistance has hindered the identification of candidate genes for selection. A pathway analysis combined with a haplotype analysis across species can narrow the potential candidate gene list down significantly. Data from QTL regions were collected from published projects in sheep, cattle, mice, rats, and human. The complete gene list was compared to the KEGG pathway database. Identified genes from the pathways were compared to determine haplotype differences between the CBA and SWR strains of inbred mice, a known model for parasite resistance. The pathways identified were Fc epsilon R1 signaling pathway, focal adhesion, regulation of actin cytoskeleton, ubiquitin mediated proteolysis, MAPK signaling pathway, and pathways in cancer. Of 172 pathway genes belonging to at least one QTL data set, over half were also found in a QTL region in another species, and 10% were found in QTL regions from four of the five species. Comparisons of the CBA to SWR HapMap indicated that of the 40 possible SNPs, 20 SNPs were differentially identified in 15 genes between the model strains. This methodology has promise as a mechanism to improve the process of candidate gene identification from QTL regions. Improvement of the candidate gene identification process in turn will lead to increased identification of relationships among genes and economically important phenotypes.

Astronomy, Mathematics and Physics
(Including **Materials Science**)

STOCHASTIC STIFFINESS MATRIX AND MODAL ANALYSIS IN NON-DESTRUCTIVE DAMAGE DETECTION IN STRUCTURES. Anthony A. Teate, Department of Integrated Science and Technology, James Madison University, 800 S. Main St., Harrisonburg, VA 22807. We examine from first principles the effects of stochasticity in the stiffness matrix on the modal differential equations for a vibrating structure. We construct generalized stochastic model equations which describe the dynamical properties of the structure. The stochastic stiffness matrix is statistically described as a stationary, random, Gaussian stochastic process with zero mean. Closed form solutions of the equations are developed through calculation of all necessary moments. It is shown that a fluctuating stiffness matrix, and concomitantly the fluctuating frequency, can lead to an incorrect estimation of the frequency bandwidth of the frequency response function. This can result in an erroneous estimation of the damping and associated deformation in a structure. Similarly, the experimentally determined phase is shown to be in error when the effects of stochasticity in the frequency are neglected. We discuss the implications of these results on modal analysis when used in nondestructive testing and evaluation of damage in structures.

EVIDENCE OF A LONG-TERM WARMING TREND IN CHESAPEAKE BAY, VIRGINIA. William C. Coles[1], Thomas C. Mosca III[2], & Yohana K. Flores[3], [1]Division of Fish and Wildlife – Department of Planning and Natural Resources – U.S. Virgin Islands, [2]Rappahannock Community College, Dept of Mathematics, 52 Campus Drive, Warsaw, VA 22572, & [3]Rappahannock Community College, 52 Campus Drive, Warsaw, VA 22572. Water temperature data collected on the York River at Gloucester Point, Va. from 1954 until the 2002 were analyzed for trend. Water temperature is a sum of many functions, some periodic and some not. By collapsing the data into annual summer and winter means, the long-term trend was exposed. The trend was established to exist in the entire Virginia portion of the Chesapeake Bay by comparison with similar means of data collected on the tidal portions of the James, York, and Rappahannock Rivers, and the Chesapeake Bay over the years 1984 through 2008. The long-term trend indicates increasing temperatures, with a recorded change of 1.5 ºC over the period of record. The warming trend is persistent across every location and time period examined. We thank Virginia Institute of Marine Science, Old Dominion University, and Virginia Department of Environmental Quality for the data used in this study.

ALGEBRAIC TORSION AND GENERAL RELATIVITY. Joseph D. Rudmin, Dept. of Integrated Sci. and Tech., James Madison Univ., Harrisonburg VA 22807. Ed Parker and James Sochacki have discovered a powerful way of finding polynomial approximations to systems of differential equations. This “Parker-Sochacki” or “Power-Series” method always finds the Taylor Series approximation to a given order, if such approximation exists, and has absolute error limits. For most practical applications, a Padé approximant derived from the Taylor Series provides better fit than

the Taylor Series. However, both Taylor Series and Padé Approximants have difficulty modeling poles in the solution. Often one can best model a pole by a change of variable, where the variable explicitly contains the pole. The change of variable can be found from the differential equations by eliminating the highest order feedback loop in the Parker Sochacki approximation, thereby simplifying those equations.

ALGEBRAIC TORSION AND GENERAL RELATIVITY. Joseph D. Rudmin, Dept. of Integrated Sci. and Tech., James Madison Univ., Harrisonburg VA 22807. Algebraic torsion offers a compact representation of Lorentz transformations, and contains the same symmetry as Dirac Spinors of quantum relativity, in a context that might be extended to general relativistic tensors, unifying the two theories. This talk elaborates on algebraic torsion as discussed in the book *Geometric Algebra and Applications to Physics* by Venzo De Sabbata and Bidyut Kumar Datta.

CALCULATING THE EXACT POOLED VARIANCE. Joseph W. Rudmin, Dept. of Physics and Astron., James Madison University, Harrisonburg VA 22807. An exact method of calculating the variance of a pooled data set is presented. Its major advantages over the many other methods are that it is simple, involves no assumptions, and is exact. The Exact Pooled Variance is the mean of the variances plus the variance of the means of the component sets." In this calculation, all means are averages weighted by the number of points in each data set. The statement will be proven, and the practical significance discussed. Please refer to this method as "the Exact Pooled Variance". This paper is available at:
http://csma31.csm.jmu.edu/physics/rudmin/PooledVariance.htm

COUPLED AND UN-COUPLED ORDINARY DIFFERENTIAL EQUATIONS: WHAT IS THE IMPLICATON? James S. Sochacki, Dept. of Math, James Madison Univ., Harrisonburg VA 22807. Let n, m be natural numbers. Let $x \hat{I} \mathbf{R}^n$ be a function depending on t and let f : $\mathbf{R}^n m \rightarrow \mathbf{R}^n$ be a function on $\mathbf{R}^n$. Consider the autonomous system of n ordinary differential equations (ODEs) of order m given by $x^m = f(x, x', x'', \ldots, x^{m-1})$. If n=1 then we only have one ODE depending on the single variable x and we say the ODE is uncoupled from any other ODE. If n>1, but we can write the n ODEs as n uncoupled ODEs, then we say the system is uncoupled. Otherwise, we say the system is coupled. In this talk I will show how to uncouple a large class of ODES that are coupled. I will also discuss the mathematical, physical, and philosophical consequences of this surprising result.

DESIGN AND CONSTRUCTION OF A TWO-BEAM ASTRONOMICAL POLARIMETER. Gregory A. Topasna, Daniela M. Topasna, Gerald B. Popko, Department of Physics and Astronomy, Virginia Military Institute, Lexington, VA 24450. We present the progress made on the two-beam optical polarimeter that was

designed and constructed at Virginia Military Institute. We discuss the transition from laboratory testing and design to the construction of a portable working prototype currently being evaluated at the 20-inch telescope at the VMI observatory. Current results and capabilities of the instrument, as well as planned observations, will be presented

EXPLORING "THE GAME OF LIFE" IN SMALL WORLDS. Richard L. Bowman, Dept. of Physics, Bridgewater College, Bridgewater, VA 22812. While Conway's "Game of Life," an example of 2-D cellular automata, has been shown to have parallels with the biological world, researchers debate the role of boundary conditions in large universes on the patterns and behaviors observed there. This paper examines the effects of various boundary conditions on small worlds, 25 X 25 cells or smaller, and illustrates the dramatically different behavior resulting from an identical starting arrangement of cells (seed), the R-pentamino. The boundary conditions are referred to by their geometric analogs: torus, box, loop, and Möbius strip.

WHEN STEVEN HAWKING'S ALIENS ATTACK, A MATHEMATICAL MODEL. Yooryeon "Eddy" Jeon and Kristopher M. Kalish, Dept. of Mathematics and Statistics, James Madison University, Harrisonburg, VA 22807. This project is a model of a hypothetical extraterrestrial biological attack on the planet earth. The model used is a modified Kermack-McKendrick S-I-R model for infectious diseases. The model itself tracks the progression of a zombie outbreak throughout the population of the Earth. It takes into account three primary factors: susceptible humans in the population, the number of zombies created in relation to the population, and the process of reanimation. Each equation also has several factors that are used to judge the spread of infection throughout the population: a birth rate that is consistent with the population, natural death, reanimation, and contact with an infected individual. A Zombie attack presented several challenges due to the fact that there is no known natural immunity or cure, and that the members of the population who die either naturally or by contact with a zombie, will reanimate and become a zombie. The method used to solve the S-I-R differential equations is the Parker-Sochacki method, developed by Dr. Edgar Parker and Dr. James S. Sochacki of James Madison University's Dept. of Mathematics and Statistics. The software programs Maple 13 and MatLab were used to model the progression of the attack through the population once the equations were set up. This was a group project between the presenters' Math 441 class at James Madison University.

Biology
(including **Microbiology and Molecular Biology**)

CORRELATION OF CHRONIC DISEASES WITH THE PRESENCE OF *TROPHERYMA WHIPPLEI* DNA IN SALIVA. Muhammed Faizan Casim & Lynn O. Lewis, Department of Biological Sciences, University of Mary Washington, Fredericksburg VA 22401. Whipple's disease is a rare systemic infection caused by the

bacterium *Tropheryma whipplei*. The disease is mainly known for its non-specific symptoms, including mal-absorption, diarrhea, and weight loss. *T. whipplei* is in the family Actinomycetes, which are environmental microbes usually found in soil and water, so a population with a poor diet and limited healthcare access could have a higher chance of having *T. whipplei*. In this study, we looked for the presence of *T. whipplei* DNA in human saliva and a correlation with any symptoms subjects might have. We tested two different populations; a population from a local free clinic with limited healthcare access and a poor diet and a population from the university with better healthcare access and a better diet available. We tested 95 subjects from the clinic and 60 students from the university. We collected saliva samples in sterile tubes and then extracted nucleic acid by using a Qiagen DNA MiniPrep extraction kit. The DNA was amplified through PCR by using Promega Master Mix with specific *T. whipplei* primers TW27F/TW182R. The medical history of the subjects was confidentially recorded for later use to make correlations. We found no positives in students or clinic populations therefore we were not able to make any correlation of chronic diseases with the presence of *T. whipplei*. Our study detected no difference in *T. whipplei* incidence between these two populations.

ENDOGENOUS REFERENCE GENE VALIDATION FOR QRT-PCR STUDIES ON HUMAN VISCERAL ADIPOSE TISSUE. Rohini Mehta[1,2], Aybike Birerdinc[1,2], Noreen Hossain[2,3], Arian Afendi[2,3], Vikas Chandhoke[1,2], Zobair Younossi[1,2,3] & Ancha Baranova[1,2], [1]Molecular and Microbiology Dept. and Center for the Study of Genomics in Liver Diseases, George Mason Univ., Fairfax, VA 22030. [2]Translational Research Institute, Inova Health System, Falls Church, VA 22042. [3]Center for Liver Diseases, Inova Fairfax Hospital, Falls Church, VA 22042. Real-time PCR (qRT-PCR) is the standard method for studying changes in relative gene expression in different tissues and experimental conditions. However, variations in amount of starting material, enzymatic efficiency and presence of inhibitors can lead to quantification errors; therefore the need for accurate data normalization is vital. Among several known strategies for data normalization, the use of reference genes as an internal control is the most common approach. Recent studies have shown that both obesity and presence of insulin resistance influence expression of commonly used reference genes in omental fat. In this study we validated expression stability of eight selected candidate reference genes using visceral adipose samples from obese (n=10) and lean (n=9) individuals. To determine the expression stability, RNA expression levels were measured in 19 visceral adipose tissue samples and cross-validated using three popular algorithms, *GeNorm*, *NormFinder* and *BestKeeper*. We recommend *ACTB* and *RPII* as stable reference genes most suitable for gene expression studies of human visceral adipose tissue.

MECHANISMS OF NEUROPEPTIDE AF-INDUCED ANOREXIA IN CHICKENS. Brandon A Newmyer[1], Paul B Siegel[2], and Mark A Cline[1]. [1]Department of Biology, Radford University, Radford, VA,24141. [2]Department of Animal and Poultry Science, Virginia Tech, Blacksburg, VA, 24060. Recently, we demonstrated the anorectic effect of neuropeptide AF (NPAF) when intracerebroventricularly (ICV) administered to

Cobb-500 chicks, which was associated with changes in hypothalamic chemistry. The purpose of the present study was to better elucidate the pathways to NPAF-induced anorexia and to test NPAF in models of hypo- and hyperphagia. In Exp 1-3, we selectively antagonized the mu, kappa, and delta subtypes of opioid receptors and co-injected NPAF in order to if NPAF'S anorectic effect was mediated through either of these subtypes; our results demonstrate that NPAF's anorectic effect is mediated through the mu and kappa but not delta subtypes of opioid receptors. In Exp 4-5, we cannulated both divisions of the paraventricular nucleus and administered microinjections of NPAF directly to these nuclei in order to determine which nucleus, if either, was the primary site of action in the NPAF pathway to anorexia. Our results demonstrated that NPAF did not affect food intake in chicks with cannulas targeting either nucleus, suggesting that neither region is the primary site of action in this pathway. In Exp 6-7, we ICV administered NPAF to chicks selected for low or high body weight and examined their food intake and behavior. We demonstrated that NPAF causes differential effects in these chicks and these effects are not associated with any behaviors competitive with appetite.

GASTRIN-RELEASING PEPTIDE CAUSES PRIMARY ANOREXIGENIC EFFECT IN CHICKENS. Collette R. Dougherty & Mark A. Cline, Radford Univ., Radford, VA 24012. The 27 residue gastrin-releasing peptide (GRP) is a secretagogue vital to digestion. We studied the effect of GRP on appetite. In Experiment 1, chicks that were injected intracerebroventricularly (i.c.v.) with GRP reduced both food and water intake in a dose-dependent manner. In Experiment 2, food-restricted chicks did not reduce water intake in response to i.c.v. GRP. Thus, the effect on water intake in Experiment 1 was prandial. GRP-treated chicks did not have reduced alimentary canal transit time for a gavaged red marker in Experiment 3, thus the effect in Experiment 1 may not be gut in origin. GRP-treated chicks had fewer feeding pecks. Behaviors including exploratory pecks, defecations, drinks, jumps and time spent standing, sitting, perching, and preening were not affected by GRP injection, indicating that the effect of GRP on appetite regulation is likely a primary effect. Thus, it is possible that GRP could be a sufficient appetite suppressant in humans.

DISPERSION AND ORIENTATION OF EGG CASES OF THE CHINESE PRAYING MANTIS ON WAX MYRTLE TREES. Heidi Etter & Robert K. Rose, Department of Biol. Sci., Old Dominion University, Norfolk, Virginia 23529-0266. The Chinese praying mantis, *Tenodera aridifolia sinensis*, was introduced to North America in 1896 near Philadelphia, Pa. A generalist insect predator inhabiting temperate successional old growth fields, this mantis is univoltine and can be iteroparous or semelparous depending on the region it inhabits. The study site for our project was a 7-year-old successional old field with volunteer wax myrtle trees located in Chesapeake, Va. One objective of the study was to determine if early laid egg cases hatch earlier than later laid egg cases. Preliminary results support this hypothesis. A second objective sought to learn if as the season progresses, egg cases are laid higher in trees and laid in a more southerly compass orientation. (An earlier study conducted

near our study site found the majority of egg cases to be oriented in a southerly direction and often high in trees. In late autumn, a southern orientation at heights increases the body temperature of the female mantis and thus her ability to convert food into eggs.) A third objective was to determine if the mean weight of the egg cases decreases throughout the season as food becomes more limited. Preliminary results support the latter study objectives.

THE CHANGE IN SMALL-SCALE SPATIAL DISTRIBUTION OF A SMALL MAMMAL COMMUNITY THROUGH OLDFIELD SUCCESSION. Jay P. Kiser & Robert K. Rose, Dept of Biol. Sci., Old Dominion University, Norfolk, VA 23529-0266. The distribution of a community of small mammals was evaluated during the succession of an oldfield habitat into a young pine forest, From 2002 through 2009 a capture-mark-release (CMR) study was conducted on a one-hectare grid at the Su Tract of Chesapeake Virginia. Over this time the small mammal community had variably consisted of cotton rats (*Sigmodon hispidus*), meadow voles (*Microtus pennsylvanicus*), marsh rice rats (*Oryzomys palustris*), eastern harvest mice (*Reithrodontomys humulis*), house mice (*Mus musculus*) and, towards the end, golden mice (*Ochrotomys nuttalli)*. During the course of the CMR study, the change in succession was defined by the presence and density of the loblolly pine trees (*Pinus taeda*) found throughout the study area. Measurements of all the loblolly pines were taken in the winters of 2005 and 2008 and used to calculate the living basal areas throughout the grid. Associations were examined through regression analysis of the basal areas and captures of each small mammal species. House mice and meadow voles were found to be significantly negatively correlated with the living basal area, whereas rice rats showed no correlation. Cotton rats and harvest mice were significantly positively correlated with basal area up to a moderate level of pine growth and then negatively correlated when pines were taller.

GROWTH AND SURVIVAL OF VOLUNTEER LOBLOLLY PINE (*PINUS TAEDA*) TREES IN AN OLD FIELD IN EASTERN VIRGINIA. Robyn M. Nadolny & Robert K. Rose, Department of Biol. Sci., Old Dominion Univ., Norfolk VA 23529-0266. Old field succession to mixed hardwood forest is often prefaced by the invasion of open spaces by fast-growing loblolly pines (*Pinus taeda*). We examined growth rates, sources of mortality and demographics of volunteer loblolly pine trees within a 1.23 ha oldfield study grid in Chesapeake, Virginia. In the winter of 2005 we learned that 15.1% of 15,675 pine trees in a 5-year-old oldfield had been killed by girdling, and a further 50.0% partially girdled, by a high density of hispid cotton rats (*Sigmodon hispidus*). Three years later we examined sources of mortality after the rodent population had dropped to near zero. During the winter of 2008 the 7-year-old pine forest lost 138 trees (0.8%) to girdling but 23.0% (3,846 stems) to natural mortality, among 16,766 stems >0.8 m tall on a 1.23 ha grid. We measured the trees again in the winter of 2009-2010 to examine the rates of growth (basal area) from period to period, and to evaluate the effects of stem density on growth and survival. We conclude that

there was a drastic shift in mortality source between 2005 and 2008-10, and that high tree density predicts higher rates of mortality in all stages of succession.

INIHIBTION OF METHACILLIN RESISTANT *STAPHLYCOCCUS AUREUS* (MRSA) BY UNIQUELY SYNTHESIZED IMIDAZOLE BASED ANTIMICROBIALS. Caitlin J. Hubbard, Randall D. Hubbard, & A. Garth McGibbon, Dept. Of Biology and Chemisty, Liberty University, Lynchburg VA. 24502.
Substituted benzene rings containing a primary amine were selected. Diazitization of the amine was carried out using $NaNO_3$ at low pH and -10°C. This allowed for the formation of an unstable azynyl intermediate. Imidazole, an aromatic nitrogen containing, five membered ring, was subject to deprotonation at N1 at pH 14.5 using 50/50 base. Resonance created a nucleophile on the 2C, which in turn attacked the benzene azynyl group; this resonates to create an azo bond between the two ring systems. Azo coupling completion was visualized by color change due to change in absorbency properties; acidification of the solution led to protonation and precipitation of the product, which was repeatedly recrystalized to ensure purity. Compounds synthesized were (E)-(2-chlorophenyl)-(1H-imidazol-2-yl)diazene, (E)-(3-chlorophenyl)-(1H-imidazol-2-yl)diazene, (E)-(4-chlorophenyl)-(1H-imidazol-2-yl)diazene, 4-[(E)-1H-imidazol-2-ylazo]phenol, and (E)-1H-imidazol-2-yl-(4-methoxyphenyl)diazene. Compounds were dissolved in 10% DMSO with 5% acetone. Kirby-Bauer disk diffusion technique was used to evaluate compound inhibition against community and clinically acquired MRSA strains. Compounds 2 & 5 were most effective for clinical MRSA strain, while compounds 1 & 5 were most effective for community MRSA strain. The addition and placement of large functional groups to the benzene ring increases the MRSA inhibitory properties of the imidazole derivatives.

THE ROLE OF A DEFENSIN PROTEIN IN ARBUSCULAR MYCORRHIZAL DEVELOPMENT. Barbara B. Kreutzer, Oscar R. Rocha & Rajendra P. Kandel, Dept. of Biol. and Phys. Sci., Marymount University, Arlington, VA 22207. Defensin proteins are found in many organisms and act as an efficient part of innate immune antifungal response. We hypothesized that some herbaceous plants express a brassica defensin protein which prevents symbiosis with mycorrhizal fungi. The defensin gene was found in nonhosts but not in hosts. SDS-PAGE indicates the gene was expressed in *Brassica rapa* exposed and not exposed to AM inoculum. Implications for AM development and plant and animal pathogenesis were discussed.

THE ISOLATION AND IDENTIFICATION OF A NEW *CAENORHABDITIS* SPECIES TO BE USED IN COMPARATIVE GENOMICS. Ann Wang, Erika Baardsen, & Theresa Grana. University of Mary Washington.
Nematodes are the most abundant multicellular organisms on the planet. To date, the most important nematode species to the scientific community is *Caenorhabditis*

elegans. *C. elegans* is commonly used in developmental, neurobiological, and genetics research because it has a defined cell lineage, is easily maintained in a laboratory, and reproduces quickly. It was also the first multicellular organism to have its genome sequenced. Many researchers have benefited from comparative studies between *C. elegans* and *C. briggsae*. These species share many of the same characteristics, however, there are important morphological differences between the two nematodes. Researchers now agree that a more closely related species that exhibits a greater degree of morphological and molecular similarity will be isolated. The discovery of a new sister species would be beneficial to the *C. elegans* research community. Four nematode species have been isolated from Fredericksburg, Virginia. 4D imaging suggests that their internal structures differ from *C. elegans.* However, they also demonstrate some morphological and behavioral similarity to *C. elegans.* The 1A, 6A, 4D, and 2G species have been sequenced and aligned with the *C. elegans* 18S ribosomal sequence. These sequences differ significantly, leading us to conclude that these species are not sister species of *C. elegans* and would be of little use in comparative genomic studies for this project.

ANNOTATION OF THE TERMITE METATRANSCRIPTOME. Neerja Katiyar[2], Natalie Fedorova[1], Alan Lax[1] Gennady Denisov[2] & William C. Nierman[3], George Mason University[2], Fairfax, Virginia, 22030 and J. Craig Venter Institute[1,2,3], Rockville, Maryland, 20850. The sequencing of mRNA transcripts from the Formosan subterranean termite, *Coptotermes formosanus*, resulted in 131,637 Sanger reads and 6,942,682 Illumina reads. Sanger reads were assembled into 25,939 unigenes, which represent up to 60% of the species transcriptome. Phylogenetic analysis showed that over 50% of unigenes exhibited no sequence similarity to other proteins or PFAM and TIGRFAM domains and may, thus, represent termite-species specific genes or non-coding RNAs. Fifty percent of the other unigenes shared similarity with other insect genomes and 25% with Trichomonada, suggesting the presence of protozoan endosymbionts (parabasalids). Pathway analysis suggested that the majority of carbohydrate, glycan, and xenobiotic pathways in the Metabiome were contributed by endosymbiotic parabasalids. In addition, the CAZy system was used to classify enzymes involved in the carbohydrate metabolism. Expression levels of the 20% most abundant transcripts from one termite cast, Cf4, were captured using RNA-Seq technology. The most abundant unigenes included two *Drosophila* homologs: Tequila, which is essential for information processing in, and myofilin, which is required for filament assembly in all muscles.

CARDIAC STEM CELLS: MIGRATION ASSAY UTILIZING VEGF AND STATINS. Stacey Rickard & Kathryn E. Loesser-Casey, Dept. of Biol., Univ. of Mary Washington, Fredericksburg, VA, 22401. Conventional treatments of heart disease do not result in myocardial restoration. However, recently discovered cardiac stem cells have been found to proliferate and differentiate into functional cardiomyocytes, giving researchers hope for use in treatment of heart disease. Understanding the factors that

influence the migration of these cardiac stem cells is paramount and therefore, my study examined the *in vitro* chemotaxic capabilities of 50 ng/ml VEGF and 0.1 μM rosuvastatin as well as the effect of age on cardiac stem cell migration. Cardiac stem cells were isolated from the hearts of newborn, 6-7 week old and 27 week old Sprague Dawley rats. Migration assays were performed on cells cultured from the newborn and 6-7 week old rats. Cell morphology indicated that both of the younger two age groups of rat cells appeared to be cardiac stem cells but the 27 week old rat cells appeared to be adipocytes. This indicates that the younger cardiac stem cells may be better suited for myocardial regeneration. The data from the migration assays produced no significant results when comparing the migration factors used, however, the newborn rat cells had significantly less migrated cells compared with the 6-7 week old rats. However, there was a second, unintentional variable. This study found that at the tested concentrations, VEGF and rosuvastatin did not induce cardiac stem cell migration. This study also supports the idea that younger cardiac stem cells are better suited to proliferate and differentiate into cardiomyocytes but age impacting the migration of cardiac stem cells cannot be concluded.

AGE-RELATED CHANGES IN STEM CELL MARKERS. Dana Hunt & Kathryn E. Loesser-Casey, Dept. of Biol., Univ. of Mary Washington, Fredericksburg, VA, 22401 The use of stem cells to promote endogenous repair of cardiac tissue provides hope for millions of Americans suffering from cardiovascular disease. Adipose tissue may provide an easy, noncontroversial supply of stem cells. However, the origin of the fat, culturing conditions, and media formulations can influence the proliferation rate and differentiation capacity of these stem cells. Mesenchymal stem cells are reported to express CD105 and lack the hematopoietic lineage markers including CD34. However, studies have demonstrated that CD34 shows high levels of expression early in passage. This study was conducted to examine whether CD34 and CD105 expression varied due to location of fat and/or the number of days the cells were cultured. Brown fat was isolated from male laboratory mice from two locations, between the scapulae and in the groin. Isolated cells were grown on slides and CD34 and CD105 were localized using immunocytochemistry. The total number of positive cells were counted and a one-way ANOVA was performed.. CD105-positive cells were found to be statistically more abundant in adipose isolated from both between the scapulae and in the groin than CD34 labeled cells or control. Control slides (no antibody) did however, show some staining indicating that we need to repeat the experiments to reduce nonspecific binding of the antibodies. Our study supports the loss of CD34 markers with cell age and the presence of CD105-positive stem cells in adipose from several locations in the mouse.

Heat Shock Protein 60 Detection by Enzyme-Linked Immunosorbent Assay in House Sparrows (*Passer domesticus*). W. Humayon, A. Dolby, & D. O'Dell, Dept. of Biol., Univ. of Mary Washington., Fredericksburg, VA 22401. Stress is caused by ever-changing environmental conditions that affect every organism. The stress response, which includes both release of stress hormones and production of heat shock proteins

(HSPs), protects animals from such biological challenges. Furthermore, not only are HSPs being applied to avian stress research on a limited basis, methods currently being employed by ornithologists to measure them do not allow them to be precisely quantified. These methods, based on colorimetric protein detection, only permit subjective comparisons to be made among samples. The objective of this project was to determine the efficacy of an alternative colorimetric HSP60 detection method that allows objective quantification, which would allow more meaningful analyses to be carried out of the factors that contribute to stress. Blood samples were collected from 16 House Sparrows at the University of Mary Washington campus during the spring of 2008 and 2009. Indirect and trap Enzyme-linked immunosorbent assays (ELISA) were used to measure HSP60 protein levels in them. Both methods detected HSP 60 proteins in the samples, but the trap ELISA was found to be more sensitive and showed less variability than the indirect ELISA. Funds were provided by Mrs. Thyra Valade Memorial Fund and UMW Undergraduate Research Fund. Thanks to V. Zimmermann, K. McAndrew & A. Dougherty for collecting samples.

BISPHENOL A INTERACTS WITH ESTROGEN RELATED RECEPTOR GAMMA TO REGULATE PRODUCTION OF C-FOS AND PS2 GENE PRODUCTS. Shannon Tucker. Department of Biology, University of Mary Washington, Fredericksburg, VA 22401. Bisphenol A (BPA) has been linked to breast carcinoma in humans for over 20 years, yet the mechanism by which BPA causes breast cancer has yet to be determined. We propose a novel mechanism by which bisphenol A acts through the estrogen related receptor γ (ERRγ), to upregulate potentially cancerous proto-oncogenes such as pS2 and c-fos. Our results show that blocking either the estrogen receptors (ER) or ERRγ, (by use of fulvestrant and 4-hydroxytamoxifin, respectively) in human breast cells reduces the levels of c-fos protein and pS2 in cells exposed to carcinogenic levels of BPA, with the greatest reduction occurring in the ERRγ blocked cells. Moreover, when both of these receptors are blocked, our results showed even lower amounts of c-fos (72.4% lower than control) and levels of pS2 proteins were undetectable. With further research, these results could finally explain the positive correlation between levels of BPA and breast cancer.

Biomedical and General Engineering

LACK OF EFFECT ON CELL-MEDIATED IMMUNITY FOLLOWING IN VIVO EXPOSURE TO ELECTROSPUN POLYCAPROLACTONE. C.E. McLoughlin1, M.J. Smith2, G.L. Bowlin1, & K.L. White, Jr.2 1Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284, 2Department of Pharmacology and Toxicology, Virginia Commonwealth University, Richmond, VA 23284. Studies in our laboratory have focused on the effects on the immune system following in vivo exposure to electrospun polycaprolactone (EPCL). We are investigating the role of fiber diameter of EPCL, specifically comparing EPCL with average fiber diameter of 1.7um (“microfibrous”) compared to 225nm (“nanofibrous”).

The results presented demonstrate a lack of effect of EPCL on cell-mediated immunity, evaluated using the anti-CD3 T-cell proliferation and the mixed lymphocyte response assays following exposure to microfibrous EPCL. In addition both forms of EPCL have been evaluated in vivo with the delayed-type hypersensitivity (DTH) response. Neither microfibrous nor nanofibrous EPCL adversely affected the DTH response. Additional studies will include evaluation of both forms in not only young but also elderly animals.

APPLICATION OF HRV FREQUENCY DOMAIN METHOD ON RESPIRATORY RATE OF MECHANICALLY VENTILATED ADULTS. N.Y. Isti Arief, Paul A. Wetzel[1], Mary Jo E. Grap, & Curtis N. Sessler Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284. The Frequency domain method of heart rate variability (HRV) has been commonly used as an indicator of the physiological state of the cardiac and autonomic nervous system; a valuable tool for non-communicative, vulnerable population such as the mechanically ventilated. This study explores the relationship between respiratory sinus arrhythmia (RSA) and HRV by utilizing the frequency domain method on 10 intubated, sedated, mechanically ventilated adults. Correlation analysis was performed on power spectral density (PSD) estimates derived from heart and respiratory rate tachograms. Results showed modest overall correlation ($R = 0.74$, $SD = 0.17$, $p < 0.0001$), consistent with expectations for this population. This result supports the exploration for respiratory rate tachogram PSD as a potential tool for supplemental non-invasive autonomic nervous system indicator.

STRUCTURAL OPTIMIZATION FOR A NANO-FLUIDIC SYSTEM MIMICKING THE TRANSPORT THROUGH NUCLEAR PORE COMPLEX. Jae H. Lee & Ramana M. Pidaparti, Deptartment of Mechanical Engineering, Virginia Commonwealth University, Richmond VA 23284. A bio-inspired nano-fluidic system mimicking the nuclear pore complex (NPC) is investigated for fluidic transport by optimizing the geometry. In general, nuclear pore complex contains very distinct geometrical components to allow various macromolecules very effectively through the pore. In order to understand and design fluidic systems for drug delivery and other applications, this study explored the optimization of a central plug location of NPC for achieving the maximum velocity for fluidic transport. The simulation is repeated for the different positions and length to get the output velocity. The approach involves conducting fluid simulations with ANSYS software and optimizing the results using EXCEL software. Based on the results obtained, one configuration of the central plug location achieved maximum velocity through the modeled nano-fluidic system.

OCULOMOTOR CONTROL IN PATIENTS WITH PARKINSON'S DISEASE. George T. Gitchel M.S. Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284. There have been few studies investigating the eye movement behavior of Parkinson's disease patients during fixation. This study objectively measured the eye movements of 36 patients with Parkinson's disease, and 20 age matched controls. Stimuli consisted of ten standardized text passages first organized by Miller and Coleman. In addition, subjects followed a randomly displaced step jump target motion. Pendular nystagmus was found

in all Parkinson's subjects, with an average frequency of 7.44 Hz. Saccadic peak velocity and duration along the main sequence were not statistically different from controls. A slower rate of reading was also noted in the Parkinson's group in terms of characters per minute, but with no more regressions than normal. Rate of square wave jerks was also found to be normal. This suggests that the hallmark feature of eye movements in Parkinson's disease is a pendular nystagmus during fixation, and all saccadic activity to be normal.

THE DESIGN AND VALIDATION OF A COMPUTATIONAL RIGID BODY MODEL OF THE ELBOW. E.M. Spratley, M.S., J.S. Wayne, Ph.D. Dept. of Biomedical Engineering, Virginia Commonwealth University. The use of computational modeling is an effective and inexpensive way to predict the response of complex systems to various perturbations. However, not until recently has this technology been used to predict the behavior of physiological systems, specifically the human skeletal system. To that end, a computational model of the human elbow joint was developed using computed topography (CT) scans of cadaveric donor tissue, as well as the commercially available software package SolidWorks™. The kinematic function of the joint model was then defined through 3D reconstructions of the osteoarticular surfaces and various soft-tissue constraints. The model was applied toward a cadaveric experiment performed by Fern et al that measured the significance of coronoid process fractures, lateral ulnar collateral ligament ruptures, and radial head resection in elbow joint resistance to varus displacement of the forearm. Kinematic simulations showed that the computational model was able to mimic the physiological movements of the joint throughout various ranges of motion including flexion/extension and pronation/supination. Quantitatively, the model was able to accurately reproduce the trends, as well as the magnitudes, of varus resistance observed in the cadaveric specimens. Additionally, magnitudes of ligament tension and joint contact force predicted by the model were able to further elucidate the complex soft-tissue and osseous contributions to varus elbow stability.

DEVELOPMENT OF A RIGID BODY COMPUTATIONAL MODEL FOR INVESTIGATION OF WRIST BIOMECHANICS. Benjamin J. Majors & Jennifer S. Wayne, Ph.D. Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284. The wrist is one of the most complex joints in the human body because of the number of bony and soft tissue structures present to accomplish the activities of daily living. The goal of this study was to develop a computational model of the wrist joint complex where joint motion and behavior is dictated by highly accurate three dimensional articular contact, ligamentous constraints, muscle loads, and external perturbations. Validation of the model was achieved by comparing predicted results from the model to the results of a published cadaveric experiment that analyzed wrist function under effects of various surgical procedures. The results showed similar trends and magnitudes between the computational model and the cadaveric experiment. While some differences were seen, the model can still be used to predict overall biomechanical function of the wrist joint complex.

A COMPARATIVE ANALYSIS OF METHODS FOR BASELINE REMOVAL IN PRETERM INFANT RESPIRATION SIGNALS. Pallavi Ramnarain & Paul A. Wetzel, Ph.D. Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284. Baseline drift removal is an critical step in preprocessing data for event detection applications. The goal of this work was to compare five different methods for basline drift removal in preterm infant respiration signals. These included a linear spline approximation, a cubic spline approximation, a recurrent neural network approach, a first derivative based approach and a second derivative based approach. Respiration was measured using a thermistor embedded in infant nasal cannula. All five methods were compared using the same event detection algorithm to evaluate their effectiveness at drift removal. The most effective method for this application was the second derivative method.

Botany

THE *FLORA OF VIRGINIA* PROJECT: A 2009-2010 UPDATE. Marion B. Lobstein, Dept. of Biol., NVCC, Manassas, VA 22205. Virginia, for its landmass, has the most diversity of vascular plant species of any state in the United States. It had the first flora, the *Flora Virginica* in 1739, yet does not have a modern *flora*. The Virginia Academy of Science for over eighty years has supported efforts to produce a modern *Flora of Virginia*. In 2001 the Foundation of the *Flora of Virginia*, Inc, was formed in 2001 and in May 2002 received 501(c) 3 status. Progress continues to be made on the efforts to develop a *Flora of Virginia* including fund-raising and public outreach efforts. Work on the content of the Flora of Virginia including the nearly 300 of the core illustrations have been commissioned, completed, and funded by VAS funds. Grants from Robins Foundation and Old Dominion have been obtained for the Project during this past year. The Academy, including the Fellows, continues to provide essential support including financial for this Project. Other progress includes completion of treatments of the dichotomous keys of 190 of the 199 vascular plant families in Virginia and the first step in developing species and genus descriptions has been completed. The second step of herbarium work on descriptions is complete and the third and final step of species genus descriptions is 94% completed. The projected publication date is late 2012 or early 2013.

ANTIOXIDANT ANALYSIS OF SELECTED TEMPERATE SPICES. Erinda Stefi & Michael H. Renfroe, Dept. Biology, James Madison University, Harrisonburg VA 22807. There is a growing interest in natural antioxidants due to their major role in human health. Spices are main targets when searching for antioxidants. The addition of antioxidants in people's diets is very important in preventing degenerative diseases such as cancer, cardiovascular, neurological diseases and cataracts. The purpose of this research project was to determine the hydrophilic and lipophilic antioxidant content of seven Mediterranean spices: basil, oregano, sage, thyme, rosemary, marjoram and mint. The antioxidant content of each spice was directly related to the drop in ABTS absorbance upon the addition of the spice extract to the HAA and LAA reagents. A standard curve was established by measurements of known concentrations of trolox, a

well-characterized antioxidant that is soluble in both hydrophilic and lipophilic assays. For each spice, a statistical analysis of the variance and the comparison of sample means were performed using the analysis of variance, followed by the Dunnett's T3 post-hoc test (≤0.05). For all the spices analyzed, higher HAA and total antioxidant activity (TAA=HAA+LAA) values were obtained from their ground form compared to their leaf form. The spice with the highest TAA of 36.25 µmol TE/g fw was thyme, while the spice with the lowest TAA of 8.43 µmol TE/g fw was sage leaves.

ANTIOXIDANT ANALYSIS OF SELECTED TROPICAL SPICES. Melanie M. Pommer & Michael H. Renfroe, Dept. of Biol., James Madison Univ., Harrisonburg VA 22807. Antioxidants are molecules which react to neutralize free radicals before they can damage biological molecules. The human body produces these naturally; however, the body's supply of antioxidants often is not sufficient to neutralize all free radicals. In this case, one may consider consuming foods or beverages that are rich in various antioxidants. Some common antioxidant-rich foods and beverages are fruits, vegetables, tea, coffee, red wine, soy products, herbs, and spices. The purpose of this research was to determine the antioxidant activity of seven ground tropical spices: mace, allspice, nutmeg, turmeric, cinnamon, cloves, and ginger. The ABTS/H_2O_2/HRP method was used to determine hydrophilic and lipophilic antioxidant content of each spice. The decrease in ABTS radical concentration due to antioxidant activity was monitored at 730 nm using a spectrophotometer. A standard curve was established using trolox. Reduction power of antioxidants extracted from each spice was reported as Trolox Equivalents (TE) in mol/g fresh weight. An analysis of variance and Dunnett's T3 test were conducted to determine significance of the difference of means (=0.05). Cloves, allspice, cinnamon, and mace were found to have the highest total antioxidant activity (TAA) ranging from 4.08 TE to 68.8 TE/g fw. Ginger, turmeric, and nutmeg had the lowest TAA ranging from 1.96 TE to 2.66 TE/g fw.

A TAXONOMIC REVISION OF THE ENDEMIC MEMBERS OF CORDIA L. (BORAGINACEAE) IN THE GALÁPAGOS ISLANDS. Julia K. Stutzman & Conley K. McMullen, Dept. of Biol., JMU, Harrisonburg VA 22807. The Galápagos Islands have long been an arena for biological diversity, scientific discovery, and more recently, conservation. Identification and documentation of the flora of the Galápagos can aid with conservation efforts. The purpose of the study reported here is to conduct a taxonomic revision of, and create an accurate taxonomic key for the four endemic members of the genus *Cordia* in this archipelago (*C. revoluta* Hook. f., *C. leucophlyctis* Hook. f., *C. anderssonii* (Kuntze) Gurke, *C. scouleri* Hook. f.). Taxonomic uncertainty among the species has resulted in the inability of these species to be evaluated for conservation status by the International Union for Conservation of Nature. A taxonomic study of these *Cordia* species will determine how they are to be identified in the field. A related GIS analysis of the population locations of each species will assess species distribution on the islands. Proper identification and distribution assessment of the endemic *Cordia* populations will allow for a determination of the conservation status of each species.

STRUCTURE OF FOLIAR GLANDS OF *STIZOPHYLLUM RIPARIUM* (BIGNONIACEAE). M. J. Drake & W. John Hayden, Dept. of Biol., UR, Richmond, VA 23173. *Stizophyllum riparium*, is a liana widely distributed in the neotropics characterized by foliar glands associated with pellucid-punctae in the leaves. We investigated structure of these glands via light and scanning electron microscopy using specimens obtained from the Kaxil Kiuic reserve located in Yucatan, Mexico. The glands arise from protoderm, are located in small depressions on both leaf surfaces, and consist of three or four basal cells that support a disk-like gland body with upturned edges. Cells of the gland body radiate from the central basal cells to the upturned gland margin; these cells are elongated parallel to the underlying epidermis. Cuticle separates from the outer periclinal walls of the gland body consistent with a merocrine-eccrine mode of secretion. Mesophyll immediately adjacent to foliar glands remains undifferentiated (no distinct palisade and spongy layers) and lack chloroplasts, rendering gland-associated leaf regions translucent. Similar, but non-pellucid, glands are known in the Asian genus *Incarvillea*; however, most foliar glands in the family are characterized by a palisade-like secretory layer supported by either a single, grossly enlarged, basal cell, or numerous small basal cells. Foliar glands in Bignoniaceae can be interpreted as homologous with glandular trichomes.

SELECTIVE FORAGING OF DIATOMS BY THE MARSH PERIWINKLE (LITTORINA IRRORATA) IN THE CHESAPEAKE BAY ECOSYSTEM. Charlotte L. Clark & Harold G. Marshall, Dept. Biol. Sci., ODU, Norfolk, VA 23529-0266. The marsh periwinkle is a common snail in tidal mud flats of Virginia's estuarine marshes of the Chesapeake Bay. It is described as a grazer of detritus and algae as it moves across the surface sediment of these inter-tidal regions. Common components of this sediment are diatoms, both of sediment and plankton origin. The objective of this study was to determine to what extent these snails utilize diatoms as a food source. Replicate samples of snails (large and small) and sediment (ca. 30 g) were taken monthly (January to April 2010) in the exposed intertidal mud flat of the Lafayette River, Norfolk. The snails were brought back to the laboratory where their fecal pellets were then collected. Diatom frustules were counted in both the fecal pellets and the sediment. There were 35 diatom taxa identified in this process. Diatoms were considered living that contained a recognizable protoplast; those lacking a protoplast as non-living. The results indicated no significant difference in the presence of empty frustules between the sediment and fecal pellets, or between the size of the snail and the sediment. The results indicated *Littorina irrorata* did not efficiently utilize living diatoms as a food source. The snail's major food source is more likely to be soft bodied algae and detrital material than these diatoms.

INTEGRATING ECOLOGY AND GENETICS TO UNDERSTAND ADAPTATION TO NOVEL ENVIRONMENTS. Carrie A. Wu, Dept. of Biol., UR, Richmond, VA 23233. Specialization to local environmental conditions can generate the adaptive population differentiation that is required for ecological speciation. A particularly dramatic example of ecological specialization involves alpine endemics, which have evolved characteristic suites of adaptations, such as strikingly prostrate, cushion-like

growth forms, in response to similar selective environments. We are investigating the ecological and genomic basis of this common ecological transition to alpine environments using the mountain monkeyflower, *Mimulus tilingii*. In contrast to the widely distributed *M. guttatus, M. tilingii* populations are confined to subalpine and alpine habitats throughout western North America, in high altitude "habitat islands" that provide a unique set of replicate evolutionary experiments in trait divergence to common ecological influences. Despite the close geographic proximity of the progenitor species *M. guttatus,* we detected high levels of genetic and phenotypic divergence between the two species. Using nuclear microsatellites and chloroplast sequence data, we demonstrate that *M. tilingii* is indeed genetically distinct from *M. guttatus*, and actually comprises its own geographically structured species complex. Common garden studies indicate that the two species are primarily divergent in vegetative, rather than floral traits, consistent with patterns of reduced stature often observed in alpine plants. In addition, greater morphological than neutral genetic differentiation between the species suggests a major role for natural selection in maintaining the distinct, compact morphology of *M. tilingii*.

INTRODUCTION TO THE CAPE FLORISTIC REGION. W. John Hayden, & M. J. Drake, Dept. of Biol., UR, Richmond, VA, 23173. Floristic regions (kingdoms) can be defined on the basis of endemic taxa at relatively high rank (families, subfamilies, tribes). Most floristic regions coincide with major continental land masses and their biotic uniqueness can be readily explained as a consequence of isolation during past episodes of plate tectonic movement. In contrast, the miniscule Cape floristic region is manifestly distinct floristically despite having a tectonic history common with the African continent. Recent floristic studies recognize 8920 species of flowering plants, 69% of which are endemic to the region; the Cape region occupies a mere 0.5% of the land area of Africa but holds 20% of the continent's plant diversity. Endemic families include: Geissolomataceae, Grubbiaceae, Penaeaceae, Roridulaceae, and Stilbaceae (s.s.). Families with more than 10 genera endemic to the Cape region include: Asteraceae, Aizoaceae, Ericaceae, Fabaceae, Rutaceae, Proteaceae, Orchidaceae, Iridaceae, and Restionaceae. Several vegetation communities exist, but fynbos, a sclerophyllous shrub land adapted to fire and acidic, nutrient-poor soils dominates the region. Many plants from the Cape region have entered the horticulture trade and are now widespread in cultivation. On the other hand, the Cape region is considered a global biodiversity hotspot, with many pressing conservation needs. Overall, the Cape flora shows significant affinities to the flora of Africa and floras of the Southern Hemisphere (Gondwana).

FLOWER AND INFLORESCENCE STRUCTURE IN *DORSTENIA* (MORACEAE): AN UNDERGRADUATE DISCOVERY SCIENCE PROJECT. W. John Hayden, Dept. of Biol., UR, Richmond, VA, 23173. Flowers of *Dorstenia* are small, unisexual, structurally reduced, and densely aggregated into capitula; as such, they test well students' basic concepts of floral morphology. Student teams were provided with inflorescences from three species of *Dorstenia* from which they prepared paraffin-embedded sections for study with light microscopy (LM); students also studied

inflorescence surfaces via scanning electron microscopy (SEM). LM and SEM images were pooled with macrophotographs and line drawings from the literature to create an image bank. In class, each student then created, from scratch, a short PowerPoint presentation designed to analyze/interpret flower and inflorescence structure, drawing as needed from the image pool. At first students balked at the relatively open-ended and unstructured nature of the assignment, but soon began to engage with the challenge of making sense of the flowers and the different ways that the same structure can appear when rendered by different imaging techniques. Students discovered for themselves the peculiar flowers of *Dorstenia,* thus broadening their understanding of the fundamentals of flower structure and floral diversity.

Chemistry

IS TiF2 REALLY LINEAR? T.C. DeVore, Department of Chemistry and Biochemistry, James Madison University, Harrisonburg VA 22807. The molecular geometry of the first row transition metal difluorides has been of interest to experimentalists and theorists for over 40 years. Recently, Wilson et al. concluded that the was no evidence that any of these compounds were non-linear. Density functional theory (DFT-B3LYP with a 3-611G++ (3df,3pd) basis set) has been used to determine the molecular geometry and the vibrational frequencies for TiF_2 and Ti_2F_6. These calculations indicated that the $^3B_2$ ground state of TiF_2 was non-linear with a bond angle of ~ 139.2°. The bond length was 180.6 pm. The $^3B_{2u}$ ground state of Ti_2F_6 has D_{2h} symmetry with terminal and bridging bond lengths of 178.3 and 180.3 pm respectively. The terminal F-Ti-F bond angle is 125.1°. The IR active Ti-F stretching frequencies are 728.19 and 625.13 cm^{-1} for TiF_2 and 755.9, 681.0 and 513.0 cm^{-1} for Ti_2F_6. The calculations indicate that in contrast to the recent conclusions reached by Wilson et al., the ground state of TiF_2 is non-linear.

THE SYNTHESIS OF NITROGEN-AND SULFUR-CONTAINING HETEROCYCLES FROM CYCLO-PROPANOL FRAGMENTATION. Georgia T. Stoyanov, Kelly L. George & Kevin P.C. Minbiole, Deptment of Chemistry and Biochemistry, James Madison University, Harrisonburg VA 22807. The prevalence of heterocycles as the backbone of common pharmaceutical entities has created a demand for simple reactions to prepare them. Our research aimed to create six-and seven-membered heterocycles containing both a carbonyl group and either sulfur or nitrogen in the ring. This is modeled after a cyclopropanol fragmentation approach to the formation of oxepanes developed previously in our group. Our current endeavor is to synthesize nitrogenous heterocycles, specifically piperidines and azepines, as well as sulfur-containing thiepanes. The nitrogenous approach begins with suitably protected α-or β-amino acid ethyl esters which were transformed by cyclopropanols via the Kulinkovich reaction. The resulting α-or β-amino cyclopropanols were then reacted with various aldehydes to form an aminal. Subsequently, various Lewis acids were investigated to promote the rearrangement of the aminal into the piperidine or azepine. Analogously, a seven-membered sulfur-containing heterocycle was formed, albeit in low yields.

ANTHOCYANIN AND ALUMINUM CONTENT OF RED AND BLUE SEPALS FROM SELECTED *HYDRANGEA MACROPHYLLA* CULTIVARS. Henry D. Schreiber, Samantha E. Wade, Kelly M. Mayhew, Andrew H. Jones & Judith B. Cain, Department of Chemistry, Virginia Military Institute, Lexington VA 24450. The primary pigment in sepals (modified leaves comprising the inflorescences) of hydrangea is an anthocyanin, delphinidin-3-glucoside. In red sepals, this anthocyanin occurs as its red flavylium cation. In acidic soil, aluminum as Al^{3+} is incorporated through the roots into the shrub and is transported to the sepals where Al^{3+} forms a complex with the blue quinoidal base anion of this anthocyanin. Analyses of the red and blue sepals of numerous hydrangea cultivars show that whereas red and blue sepals of the same cultivar have the same anthocyanin content, individual cultivars can be classified by their unique anthocyanin contents. For example, the popular remonant or cold-hardy cultivars have 80-120 µg anthocyanin per g fresh sepal, while the most vibrantly colored cultivars have over 300 µg anthocyanin per g fresh sepal. The anthocyanin content of a particular cultivar is typically proportional to its perceived intensity of coloration. Bluing of the sepals on the average require about a 10-fold molar excess of aluminum over anthocyanin, meaning that the threshold aluminum content for bluing is also cultivar dependent. Experiments have also shown that greater aluminum contents than the threshold for that cultivar do not result in bluer sepals, in agreement with a chemical model for bluing.

CHEMICAL CONTROL OF PAPERWHITE (*NARCISSUS TANZETTA* ZIVA) GROWTH AND FLOWERING. Timothy V. Johnson & Henry D. Schreiber, Department of Chemistry, Virginia Military Institute, Lexington VA 24450. Paperwhites, *Narcissus tanzetta* Ziva, are plants that are commonly grown from bulbs for winter blooming indoors. They are known for their stunning white flowers, but these flowers are often perched on top of a much too-tall stem that seems out of proportion to the flowers. In a previous study, paperwhite bulbs were grown in alcoholic solutions (optimal 5 vol% ethanol) instead of water, resulting in shorter stems to remedy the plant's "floppiness" without sacrificing floral quality. This study expanded the prior work by testing a wider variety of alcohols and other common laboratory and household chemicals. Growing paperwhites in a 5 vol% solution of ethanol in water indeed stunted the stems of the plants, but also lessened the number of flowers, in contradiction to the previous study. 5 vol% solutions of ethanol, methanol, isopropanol, ethylene glycol, glycerol, and acetone in water were all effective at stunting the stem growth by 33-50%, but the number of flowers also tended to be about 33% less than the control (water). The size of the blooms as well as the bloom period remained unaffected by the chemical additives. The chemical additives appeared to stunt but not kill the paperwhites, for which the additives acted as a mild toxin. Thus, although alcoholic solutions are effective in producing dwarf paperwhites, the previous conclusion that floral quality remains unaffected is misleading.

SUBUNIT INTERACTION OF THE CAP METHYTRANSFERASE. Joolan Saroor, Jessica N. Skeeter, Jeanhee Chung & Thomas O. Sitz, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. The 5'-end of eukaryotic mRNA is capped and

methylated in the N-7-position of the guanine base generating a fully functional cap structure. If the cap is not methylated at this position, the mRNA is not translated, i.e. this methylation is essential for gene expression. The enzyme that methylates the N-7 position, Guanine-7-methyltransferase, has been expressed as a His-tag protein in *E. coli*. The addition of histidines at the N-terminus allows the enzyme to be purified on a Nickel column. The full length enzyme, 476 amino acids long, and the deletion mutation, 120 amino acids removed from the N-terminus, are about 80% pure after the nickel column. To further purify the enzymes, a positively charged ion-exchange column (Mono Q-Sepharose) was used resulting in greater than 95% purity. This purified guanine-7-methyltransferase (full length and deletion mutation enzyme) was then applied to a FPLC-Superose 12 gel exclusion column and two major peaks of protein were observed for both the full length and the deletion mutation enzyme which corresponded to about 90% homodimer and 10% monomer for each respectively. The purified enzymes were also analyzed by blue-native polyacrylamide gel electrophoresis and the deletion of 120 amino acids had no affect on the subunit interaction, i.e. about 90% dimer. The enyme samples were then subjected to cross-linking with 1-Ethyl-3-(3 dimethylaminopropyl)carbodiimide (EDC) and N-Hydroxysuccinimide (NHS). Both the full length and deletion mutation were not cross-linked, suggesting that dimers were not formed by charge interaction (electrostatic interaction).

POLYCEPHALIC (MULTI-HEADED) CATIONIC AMPHIPHILES AS NOVEL SURFACTANTS AND ANTIMICROBIAL AGENTS. Robby Davis[1], Christian Schwantes[1], Devon Flaherty[2], Kevin Caran[1], Kevin Minbiole[1] & Kyle Seifert[2], [1]Department of Chemistry and Biochemistry, James Madison University, Harrisonburg VA 22807 and [2]Department of Biology, James Madison University, Harrisonburg VA 22807. We recently reported the synthesis and colloidal study of a novel series of biscationic bicephalic amphiphiles, each with two charged head groups and a single nonpolar tail connected via an arene core. Initial biological testing showed that six of seven amphiphiles tested were antibacterial and/or antifungal; several inhibited bacteria more effectively than ampicillin. We aim to build on this preliminary data and investigate the structure dependence and mechanism of antimicrobial activity of a wide range of cationic multiheaded amphiphiles. We will incorporate different substitution patterns as well as vary the cationic and hydrophobic groups to access a diversity of related amphiphilic structures. Colloidal characteristics of these surfactants will be assessed. We plan to determine the MIC and mechanism of action of each synthesized compound. Then, correlation of monomeric structure, aggregation tendencies, and mechanism of action will be examined.

AMPHIBIAN CHEMICAL DEFENSE: IDENTIFICATION AND APPLICATION OF ANTIFUNGAL METABOLITES FROM JANTHINOBACTERIUM LIVIDUM AND PEDOBACTER CRYOCONITIS. Jacob Smith & Kevin P. C. Minbiole, Department of Chemistry and Biochemistry, James Madison University, Harrisonburg VA 22807. To develop a probiotic antifungal treatment against the deadly fungus *Batrachochytrium dendrobatidis*, anti-fungal metabolites from bacteria on the amphibians' skin were identified. As a preliminary step, metabolites from *Pedobacter*

cryoconitis separated through HPLC are currently being tested against *B.d*. A previous study of the mountain yellow-legged frog (*Rana muscosa),* infected with *B.d.*, provides a model for the probiotic treatment of amphibian populations with *Janthinobacterium lividum*. A study is underway to measure the effects of *Janthinobacterium lividum* against Chytridiomycosis on the extirpated Panamanian golden frog (*Atelopus zeteki).* A soil extraction protocol to detect violacein, currently under development, will allow for the identification of *J. lividum* in soil samples. If successful, this could simplify the transition from the lab to the wild.

THREE *ARABIDOPSIS TALIANA MYO*-INOSITOL 1-PHOSPHATE SYNTHASE GENES ENCODE BIOCHEMICALLY SIMILAR ENZYMES. Xinyi Huang, Marcy Hernick & Glenda E. Gillaspy,
Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. Inositol L-*myo*-inositol 1-phosphate synthase (MIPS; EC 5.5.1.4) catalyzes the conversion of D-glucose 6-phosphate to 1L-*myo*-inositol 1-phosphate. The expression pattern and metabolite function of three MIPS genes from *Arabidopsis thaliana* have been characterized. In order to prove that these proteins were similar enzymes with similar catalyzing ability, MIPS1, MIPS2 and MIPS3 ORFs were cloned into vector pDEST17 and induced in *E. coli* BL21(DE3) strain. The N-terminal his-tagged MIPS proteins were purified by Ni-IMAC (Fig.1). The yield of MIPS proteins were among 4 to 20 mg/L culture. The catalytic activity of MIPS proteins was measured under steady-state conditions, by coupling reaction with excessive amount of *myo*-Inositol monophosphatase (IMP, EC 3.1.3.25) at 30°C. The kinetic parameters (k_{cat}, K_M, k_{cat}/K_M) were obtained by fitting the Michaelis-Menten equation to the initial linear velocities measured at the various substrate concentrations. The kinetic properties of MIPS1, MIPS2 and MIPS3 were not significantly different among each other ($\geq$ 2 fold) Thus, we concluded that MIPS proteins were similar enzymes in plants, and the different impact on growth and cell death was due to the developmentally and spatially regulation of MIPS genes expression.

EXPRESSION AND PURIFICATION OF Rv0323c, A HYPOTHETICAL MYCOBACTERIAL PROTEIN. J. Boggia & M. Hernick, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. Mycothiol is the primary reducing agent used by mycobacteria to prevent against oxidative damage. Consequently, enzymes involved in mycothiol biosynthesis are targets for antibiotic development. One of the key steps in this pathway is the hydrolysis of GlcNAc-Ins to form $GlcNH_2$-Ins and acetate. Under normal conditions, this reaction is catalyzed by the enzyme MshB. However, the MshB knockout is capable of producing some, albeit decreased, mycothiol indicating that there are one or more redundant enzymes. Based on sequence alignment data, there are two potential enzymes that may fulfill this function, mycothiol-conjugate amidase (MCA) and the hypothetical protein Rv0323c. We have cloned the genes for both of these enzymes into vectors that allow for the recombinant expression of these proteins in *E. coli*. We have been able to express and purify the protein encoded by the Rv0323c gene. Current efforts are focused on characterization of the Rv0323c function, and determination of whether it possesses GlcNAc-Ins deacetylase activity.

SOLUTION-PHASE SYNTHESIS OF CuPt BIMETALLIC CATALYSTS AND THEIR APPLICATIONS IN CO OXIDATION. Q. Liu[1], D. W. Goodman[2], J. D. Batteas[2] & R. E. Schaak[3] [1]Department of Chemistry and Biochemistry, James Madison University, Harrisonburg, VA 22807, [2]Department of Chemistry, Texas A&M University, College Station, TX 770842 and [3]Department of Chemistry and Materials Research Institute, The Pennsylvania State University, University Park, PA 16802. A mixture of CuPt nanospheres and nanorods was directly synthesized in liquid phase. The characterization of Transmission electron microscopy (TEM) and X-ray diffraction (XRD) demonstrated that the atomic ratios of Cu/Pt in both spheres and rods are very close to 1. Moreover, the length of the nanorods can be tuned by changing reaction conditions in the range of 10 to 55 nm and a possible formation mechanism for these nanorods was hypothesized. To investigate the catalytic activities of resulted CuPt nanoparticles, the nanospheres and nanorods were separately deposited on Al_2O_3 and then used as catalysts probing the light-off temperature for oxidation of CO to CO_2 in a closed system.

METHOD DEVELOPMENT FOR ELEMENTAL ANALYSIS OF FOLIAR BLUEBERRY (*VACCINIUM CORYBOSUM* L.) SAMPLES. Allison E. Glick, Denay M. Fuglie, Braydon P. Hoover & Roman J. Miller, Dept. of Chem., Eastern Mennonite Univ., Harrisonburg, VA 22802. Nutrient levels in blueberry leaves from established Blueray, Coville, and Jersey cultivars were analyzed by flame atomic absorption spectroscopy (FAAS) in a method development to use in research for a model organic blueberry farm. Foliar samples were oven-dried or oven-dried and dry-ashed at 450° C, then digested with 6 M HCl or concentrated HNO_3, and compared for higher extraction of the elements Fe, Zn, Mn, Cu, Ca, and Mg. There were no differences in which acid is used to digest nor whether the sample is ashed. However, the blueberry cultivars did differ in elemental concentrations and cannot be grouped together for nutrient evaluation. Older leaves also had different elemental concentrations as measured by FAAS than younger leaves gathered from the same bush. FAAS could also detect difference between a healthy bush and one recovering from stress. Using oven-dried leaf samples digested with 6 M HCl is the method of choice to measure the nutrients Fe, Zn, Mn, Cu, Ca, and Mg. (Research supported in part by USDA Specialty Crop Grant # 2008-427, Commonwealth of Virginia, Department of Agriculture and Consumer Services.)

SPECIFIC ION EFFECTS ON PROTEIN AGGREGATION. Yanjie Zhang[1*], Branden Deyerle[1], Justin Hagerman[1], Paul S. Cremer[2], [1]Department of Chemistry and Biochemistry, James Madison University, Harrisonburg, VA 22807 and [2]Department of Chemistry, Texas A&M University, College Station, TX 77843. Specific ion effect was first noted by a protein chemist, Franz Hofmeister, over a hundred years ago that ions showed varying abilities to precipitate protein molecules out of solution. This effect is known as a recurring trend in a variety of physical and biochemical processes such as protein stability, enzyme activity, and colloidal assembly. Despite its generality, the understanding about the mechanism of the Hofmeister effect on molecular level is far from complete. In this presentation, interactions between ions and

protein molecules were investigated in a temperature gradient microfluidic setup and the mechanism of the Hofmeister effect was elucidated.

BIOMINERALIZATION TEMPLATED BY AMINO ACID-BASED CHIRAL MOLECULES. Justin Hagerman, Branden Deyerle, Yanjie Zhang, Department of Chemistry and Biochemistry, James Madison University, Harrisonburg, VA 22807. Biomineralization is an extremely widespread phenomenon in the biological world. Examples of biominerals include silicates in algae and diatoms, carbonates in invertebrates, and calcium phosphates and carbonates in vertebrates. The functions of biominerals range from magnetic sensing to structural support. Herein, amino acid-based chiral molecules were employed as model systems to direct the growth of biominerals. The role of chiral molecules and the mechanism for the nucleation and crystallization of biominerals will be discussed.

HOFMEISTER EFFECTS ON THE PHASE BEHAVIORS OF THERMAL RESPONSIVE POLYMERS. Branden Deyerle, Justin Hagerman, Yanjie Zhang, Department of Chemistry and Biochemistry, James Madison University, Harrisonburg, VA 22807, Over the last 120 years, a wide variety of phenomena from protein folding and enzymatic activity to colloidal assembly and protein crystallization have been shown to follow the Hofmeister series. Despite its ubiquity, a molecular level understanding of the Hofmeister series is still lacking. Herein, we will employ a model system, phase transitions of thermoresponsive triblock copolymers, to investigate the mechanism of the Hofmeister series on the molecular level. The phase transition temperatures of these triblock copolymers were measured in the presence of Hofmeister anions and the data were correlated with the properties of anions.

EXPERIMENTAL AND COMPUTATIONAL APPROACHES TO IDENTIFY SELECTIVE INHIBITORS OF CASEIN KINASE 1 FROM *TRYPANOSOMA CRUZI*. Sahil Khanna, Pablo Sobrado & David Bevan, Department of Biochemistry, Virginia Tech, Blacksburg VA 24060. *Trypanosoma cruzi* casein kinase 1 (TcCK1) is a multifunctional Ser/Thr protein kinase that catalyzes the phosphorylation of key proteins in regulation pathways. Its function in cell growth makes TcCK1 a potential drug target to prevent the growth of *T. cruzi*. Infection by *T. cruzi* parasite results in Chagas disease, known to cause sudden cardiac failure. Human casein kinase 1 delta (hCK1δ) is important to proper physiological function of human cells, therefore the drugs developed need to be selective towards TcCK1 over hCK1δ. Computational docking experiments of 14 potential inhibitors to both TcCK1 and human casein kinase 1 delta (hCK1δ) were performed using Dock6. Analysis of the ATP binding pocket of TcCK1 and hCK1δ showed exploitable structural differences, particularly spacing between residues E49/D149 in TcCK1 and E50/D149 in hCK1δ. The resulting grid scores have indicated 5 inhibitors for *in vitro* study, (R)-DRF053, Purvalanol B, CKI-7, PF670462, and D4476. TcCK1 was cloned into Top-10 *E. coli* cells and co-expressed along side chaperone protein complexes DnaK-DnaJ-grpE and GroEL-GroES. TcCK1 was partially purified utilizing an Immobilized Metal Affinity Columns (IMAC). A γ-^{32}P-ATP assay was used to determine a Km value of 2.3±0.72 mg/mL for α-casein as

a substrate. A method to obtain active enzyme was formed, and can be used for further inhibition studies. Ki values for selective inhibitors determined by the *in silico* study can be obtained.

Computer Science

USING SECOND LIFE FOR COMPUTER SCIENCE EDUCATION. Robert A. Willis Jr. Department of Computer Science, Hampton University. Over the past few years, I have noticed that our students are reluctant to approach learning computer science in the traditional ways. Computer science requires beginning students to learn the concepts of computer science and the art of programming. While disparate, both of these facets require a good deal of study using texts and practice. Second Life is used to implement a number of innovative interactive tutorials tailored for this generation of students. Furthermore, the environment is conducive for instruction in a number of other areas in computer science (and other disciplines). Second Life is a three dimensional virtual world. It is a social environment that allows people to "live" much as they do in real life. People (represented as avatars) can purchase land, build houses, work, play, and participate in many other activities. It is an ideal environment to reach all levels of students.

INTERACTIVE PARAPHRASE TRAINING: THE DEVELOPMENT AND TESTING OF AN ISTART MODULE. Chutima Boonthum. Department of Computer Science, Hampton University Hampton University. Comprehension of science texts is challenging, particularly when the reader lacks the skills or knowledge necessary to fill in conceptual gaps in the text content. The iSTART system was developed to help readers learn and practice reading strategies to improve their ability to comprehend challenging text. This study describes a new iSTART module recently developed and tested, called Interactive Paraphrasing (IP), in which students are interactively and adaptively taught how to paraphrase sentences. We compared the effects of iSTART to iSTART with IP (IP-iSTART) with high school students on their strategy use and ability to comprehend text. IP-iSTART increased skilled readers' self-explanation quality, improved their ability to answer online comprehension questions, and increased their use of paraphrases after training. Less skilled readers benefited most in self-explanation quality from the original version of iSTART. Results are discussed in terms of tailoring reading strategy training to the needs of the reader.

GENERATION Y AND COMPUTER LITERACY/EDUCATION. Angela Hayden. Department of Computer Science, Hampton University Hampton University. The generation of Americans born between 1977 and 1994 are affectionately known as Generation Y. They hold to similar values of their parents, but will challenge authority and the information given them in any setting. They possess a variety of skills including computer skills, making them the most computer literate of all generations prior to them. They can be stimulated through a variety of means, most of which are visual and audio. They also appreciate having fun more than just learning facts. Strategies for both study and pedagogy offered as suggested means to help students learn have not changed

much in recent years and can still be used for those entering college over the next two or three years. One such strategy includes visual/auditory where students are asked to read aloud, record and play back definitions to terms, or visualize certain tasks. At HU, we offer students in our CSC 120, Intro to Computer Literacy course a method that requires them to do much more than just passively sit in class and take notes. This method, where students learn computer applications using hands-on activities, is not without its problems and challenges, but overall most students do extremely well and some have express not only satisfaction with the course, but acknowledge that learning has occurred.

Education

THE ART LOVER'S PROBLEM. W. Michael Gentry, Department of Mathematics, Mary Baldwin College, Staunton, VA. An application of algebra, without the use of calculus, to solve *The Art Lover's Problem:* How far from a Pablo Picasso portrait should an art lover stand in order to obtain the best possible view? Encourages first-year college students to think actively; helps them understand how a scientist sees or interprets the physical world. Patient problem-solving and algebraic skill are both necessary. Basic skills in algebra precede a deeper more theoretical understanding. Student responses indicate that although conceptual understanding should come first, it remains shallow in nature, unless and until some facility in algebra is developed.

STORMWATER MANAGEMENT AT THE SCIENCE MUSEUM. Lindsay M. Walker[1] & Eugene G. Maurakis[2], [1]Randolph-Macon College, Ashland, VA and [2]Science Museum of Virginia, Richmond, VA. Stormwater runoff has been a growing problem for watersheds throughout the United States. As stormwater flows across paved surfaces, such as roads, parking lots, and roofs, it picks up trash, fertilizers, pesticides, PCB's, and other pollutants which end up in larger bodies of water such as the Chesapeake Bay. To improve the quality of water for local waterways such as the James River and the Chesapeake Bay, the Science Museum is collaborating with a variety of groups to implement stormwater management technologies; porous pavement, rainwater harvesting systems, green roof, BayScapes gardens, bioretention areas, and tree box filters. The Museum is creating exhibits and demonstrations which correlate to the Virginia Standards of Learning so the students can learn about stormwater management technologies. Funded by the National Fish & Wildlife Foundation.

CONNECTING GRADUATE RESEARCH TO UNDERGRADUATE AND SECONDARY SCIENCE EDUCATION. Lisa S. Webb[1], Roberto A. Flores[2], Geoffrey C. Klein[1], Michael D. Meyer[1] & Gary J. Whiting[1], [1]Department of Biology, Chemistry and Environmental Science and [2]Physics, Computer Science and Engineering, Christopher Newport University, Newport News, VA. CNU's NSF funded GK-12 project, Linking Urban Water Quality with Science Education in the Chesapeake Watershed, involves placing graduate Environmental Science and Computer Science

students in a 9th grade Earth Science classroom where they will utilize an interdisciplinary, guided-inquiry based approach to address an environmental question (i.e. what is the health of the local watershed and what events and actions influence it?). The project is interdisciplinary, integrating environmental science, basic and applied biology (ecology and entomology), chemistry and computer science, and includes a combination of classroom, laboratory and field experiences. In order to extend the project's connection to include undergraduate science education, we field-tested the labs and activities in an introductory biology laboratory for non-science majors. We describe the scope of the activities and discuss the success of utilizing this approach to connect graduate level research to undergraduate and secondary science education. The authors would like to acknowledge the generous financial support of the National Science Foundation (GK-12 Program, award # 0841295).

RESTORATION OF DEGRADED WETLANDS IN AN URBAN SETTING: A COMMUNITY PARTNERSHIP. M. T. Muller[1], M. S. Semcheski[1], T. A. Egerton[1], C. L. Clark[1] & K. DuBois[2], [1]Department of Biology, Old Dominion University, [2]City of Norfolk. Considering the drastic loss of tidal wetlands in the Chesapeake Bay Watershed over the past century, a sense of environmental stewardship has began to percolate. Urban environments provide a distinctive suite of challenges for wetland restoration that requires cooperation from a number of city officials and community leaders. In the City of Norfolk, an aggressive plan to rehabilitate wetlands on city property has begun and consequently provided a unique learning opportunity for students from elementary age through graduate school. Restoration sites within Colley Bay in Norfolk, Virginia which is adjacent to Larchmont Elementary School and Old Dominion University have been identified. Elementary students have been growing the marsh grass, *Spartina alterniflora*, and will assist in the planting, while the ODU Biology Graduate Student Organization have made the technical plans and submitted all necessary permit applications. With funding from the City of Norfolk Wetlands Board and assistance from the Lafayette River Wetlands Partnership, this project promises to have significant positive impacts on the environmental quality and aesthetics of the area.

Environmental Science

ESTABLISHMENT OF A CRITICAL THERMA MAXIMA (CTMAX) FOR THE MAYFLY *ISONYCHIA BICOLOR* (EPHEMEROPTERA). C.A. Sims, B.S. Echols, J. Brunkow, W. Nuckols and D.S. Cherry. Department of Biology, Virginia Tech. A study of Critical Thermal Maxima (CTMax) for the mayfly, *Isonychia bicolor*, began in April 2008 and extended to October 2009. Organisms were collected using d-frame dip nets and hand picking techniques from Sinking Creek, Giles County, Virginia. Mayflies were subject to gradual temperature change and monitored for behavioral physical consequences of the increased thermal stress were observed including sporadic swimming and ecological death, defined as the inability to cling to surfaces. Results were compared with past research in order to address accuracy. In general the results showed that the mayflies were more sensitive to thermal changes. Mayflies are often

used in laboratories as test organisms to assess environmental stressors, however specific conditions have not been established to keep this organism in the best condition for testing. It appears that 34°C is the CTMax for this species.

MODELING FISH SPECIES DIVERSITY IN FORESTED AND URBAN STREAMS: A BASELINE FOR CLIMATE CHANGE. Eugene G. Maurakis (1,2), David V. Grimes (3,1) Suzy Short (1), and Amanda Schutt (4,1). (1) Science Museum of Virginia, 2500 W. Broad St., Richmond, VA 23220 (2) University of Richmond, VA 23173, (3) VA Dept. Environmental Quality, Richmond, VA 23060, (4) Center for Environmental Studies, Virginia Commonwealth University, Richmond, VA 23284. Objectives are to model fish species richness, diversity and evenness in watersheds of Quantico Creek (forested watershed) and Cameron Run (urban watershed) using biological, physio-chemical factors, and land use and human population data per intra-drainage stream order area. To date, 32 species of fishes (11 families) have been collected in 272 collections made from Nov. 2008-May, 2010. Overall, species richness, diversity, and evenness in forested areas are significantly higher than those in urban streams. Stream order, water depth, and month account for the variation in species richness in the forested watershed. In contrast, elevation and stream flow account for the variation in species richness in the highly modified stream beds of the urban watershed. Funded by the U.S. Department of Energy.

STORMWATER MANAGEMENT AND EDUCATION CENTER AT THE SCIENCE MUSEUM. Eugene G. Maurakis (1,2) and Todd Janeski (3), (1) Science Museum of Virginia, 2500 W. Broad St., Richmond, VA 23220 (2) University of Richmond, VA 23173, (3) VA Dept. Conservation and Recreation, 203 Governor, St., Richmond, VA 23219. We are developing a regional environmental site design demonstration, education, and training center. We are retrofitting a highly visible community facility with low impact development stormwater management practices, monitoring their effectiveness, and developing a training/certification program that showcases those measures. These include: bioretention facilities, a Bayscapes garden, tree box filters, porous pavement, rainwater harvesting system, and a green roof. We will evaluate their performance through a quality assured monitoring program. To achieve the scale necessary to demonstrate their applicability, we will conduct a sewershed low impact development retrofit survey of the entire sewer drainage area of Shockhoe Creek (8000 acres, about 2/3 of the City of Richmond CSO system) to the James River. Recognizing the effects of climate change on stormwater planning, we will conduct a 2nd survey utilizing predicted increases in frequency and intensity of storm and drought conditions. And applying a cost benefit analysis, we will demonstrate their benefits in relation to the cost to address damages incurred by uncontrolled stormflows. Funded by the National Fish & Wildlife Foundation.

THE IMPACT OF DEVELOPMENT ON SYMBIOSES FROM THE POTOMAC RIVER VALLEY TO THE CHESAPEAKE BAY. M. Aziz, A. Carpenter, D. Griffith, L. Kinne, and C. Milling, George Mason University. Regional development in the Potomac River Valley (PRV) has placed stressors on local symbioses affecting

ecosystem services. Symbiosis can be defined as "two or more forms of life that interact." Many symbiotic relationships that provide ecosystem services exist in the PRV. These symbioses include plants with pollinators, oysters with submerged aquatic vegetation, and mycorrhizae with plants. Their services include: water filtration and habitat restoration. The last twenty years has shown tremendous growth in population in the Northern Virginia region, with counties growing up to 96 percent. Development as a result of this population expansion has led to increased stressors including habitat degradation and fragmentation, sedimentation, toxic and organic pollutants, and changes to flow regimens. This phenomenon has the potential to fundamentally alter symbioses and the ecosystem services they provide to humans. It is unclear how long the PRV ecosystem can be maintained given the effects of these stressors, but it is unlikely that the resilience is absolute. Society has prospects to help the ecosystem: education and implementation of new policies and technologies could allow the natural symbiotic relationships to continue and recover, ultimately benefiting the PRV.

PRELIMINARY ANALYSIS OF BAY FILTER UNIT SUCCESS IN FREDERICKSBURG, VA. Michael L. Bass and Marion A. Cross, University of Mary Washington, Fredericksburg, VA. Virginia Department of Conservation and Recreation (DCR) evaluates and approves manufactured treatment devices (MTD's) deemed reasonable methods of prevention, control and/or treatment of storm water runoff. MTD's seeking certification for runoff quality control in Virginia will only be approved for total phosphorous (TP) removal at this time, requiring 50% TP removal for influent with TP concentrations ranging from 0.15 mg/L to 0.5 mg/L. Baysaver Technologies, Inc has applied for interim approvals to use the Bay Filter System to meet Virginia requirements for treating stormwater runoff. A monitoring program is intended to demonstrate through field testing that Bay Filter is capable of removing contaminants from stormwater runoff. Results will determine if the filter meets stormwater regulations. The field testing program will collect discrete samples from the influent and effluent of the BayFilter. These samples will be analyzed using standard EPA protocols for total suspended solids (TSS), particle size distribution (PSD), nutrients as well as metal concentrations. Removal efficiencies will be calculated based on this data using standard scientific methods. Precipitation and flow records will be taken during these events as well. The testing program is anticipated to take 12-18 months to complete and will include at least 15 qualifying storm events. BayFilter systems to be monitored will treat the stormwater runoff from Trinity Episcopal Church property in Fredericksburg, VA. Stormwater runoff from the paved area transports dissolved, colloidal, suspended and settleable solids in a heterogeneous mixture, which includes metals, organic compounds and nutrients.

REPORT OF MONITORING FOR SELECT WATER QUALITY PARAMETERS IN THE STORMWATER MANAGEMENT PONDS FOR A COMMERCIAL DEVELOPMENT. Michael L. Bass, Marion A. Cross and Leah N. Sumner. Earth and Environmental Sciences, Univ. of Mary Washington, Fredericksburg, VA. In the 1990's the Silver Company built Central Park in Fredericksburg, Virginia. In the process 6.9 acres of wetlands were destroyed and had to be reconstructed in compliance with

section 404 of the Clean Water Act. Storm water management ponds were built with the wetland benches around them within Central Park and a mitigation site was created along Massaponax Creek in Spotysylvania County. This study monitored the storm water management ponds of Central Park. This background data will be used as preliminary info on nutrient loads in these ponds when the new DCR regulations are in place. Water quality monitoring was conducted on the storm water management ponds and the migrated wetland site. Dissolved oxygen, pH, temp., and conductivity were taken on site. Water samples were taken and tested in the laboratory for nitrates, phosphates, alkalinity and hardness. Testing was done on the same day as the samples were taken. LaMotte test kits were used for each test, and the nitrate and phosphate levels were measured with a colorimeter. The storm water management ponds exhibited normal ranges in chemistry values, with high nutrient levels in the Best Buy, Kohl's and Upper Target ponds still not exceeding EPA maximum dose levels. These ponds also exhibit higher alkalinity and water hardness levels and are constructed with culverts of concrete that is weathering, which could contribute to the elevations. Preparations are being made to monitor rainwater and surface runoff prior to entering the stormwater management ponds.

THE EFFECT OF RAIN GARDENS ON RUN-OFF WATER BACTERIA LEVELS. J. G. Felthousen, E. Wallace & Dr. B. Kreutzer, Department of Biology, Marymount University, Arlington VA 22207. A rain garden is a landscaped depression, designed to improve water quality by absorbing and filtering harmful substances in run-off water. In previous studies, rain gardens removed petroleum and fertilizers from run-off water. This study examined the effect of rain gardens on coliform bacteria found in run-off water. Coliform bacteria are medically important microorganisms often found in contaminated run-off water. During or immediately after rainfall, water samples were collected from two sites, a local rain garden and an adjacent parking lot. Each water sample was immediately transported to the lab and plated on differential media**.** After incubation, the rain garden and parking lot plates were assessed for coliform and non-coliform colony forming units. According to the results, after the rain garden was flushed with initial spring rains, some coliform bacteria levels dropped. To draw further conclusions, sampling must continue at local rain garden sites throughout the year.

PRELIMINARY ANALYSIS OF BAY FILTER UNIT SUCCESS IN FREDERICKSBURG, VA. Michael L. Bass and Marion A. Cross, University of Mary Washington, Fredericksburg, VA. Virginia Department of Conservation and Recreation (DCR) evaluates and approves manufactured treatment devices (MTD's) deemed reasonable methods of prevention, control and/or treatment of storm water runoff. Virginia's stormwater management programs are implemented under: Virginia Stormwater Management Law and Virginia Stormwater Management Regulations. DCR maintains the authority to regulate BMP methods used in Virginia to control stormwater runoff under the Virginia Technology Assessment Protocol (VTAP). The assessment protocol deals with the MTA's that are designed for, reducing stormwater runoff volume, reducing peak runoff rate and/or and reducing total phosphorous (TP). The goal of the VTAP regarding runoff quality control is to determine how much a specific

MTD can remove total phosphorous (TP). MTD's seeking certification for runoff quality control in Virginia will only be approved for TP removal at this time, requiring 50% TP removal for influent with TP concentrations ranging from 0.15 mg/L to 0.5 mg/L. Additional requirements are 80% removal of TSS for influent with TSS concentrations ranging from 100 mg/L to 200 mg/L and > 80% removal of TSS for influent with concentrations greater than 200 mg/L. Baysaver Technologies, Inc has applied for interim approvals to use the Bay Filter System to meet Virginia requirements for treating stormwater runoff. Flow through the filter system in gravity-driven and self-regulating. The monitoring program is intended to demonstrate through field testing that Bay Filter is capable of removing contaminants from stormwater runoff. The field test will demonstrate the removal efficiencies attained by the system for TSS, TP, Cu, Zn and other pollutants. This will then be used to confirm that the system meets stormwater regulations which require the removal of a minimum 80% of the total suspended sediment load and treatment of nutrients to the maximum extent feasible. The field testing program will collect discrete samples from the influent and effluent of the BayFilter. These samples will be analyzed using standard EPA protocols for total suspended solids (TSS), particle size distribution (PSD), nutrients as well as metal concentrations. Removal efficiencies will be calculated based on this data using standard scientific methods. Precipitation and flow records will be taken during these events as well. The testing program is anticipated to take 12-18 months to complete and will include at least 15 qualifying storm events. BayFilter systems to be monitored will treat the stormwater runoff from Trinity Episcopal Church property in Fredericksburg, VA. Stormwater runoff from the paved area transports dissolved, colloidal, suspended and settleable solids in a heterogeneous mixture, which includes metals, organic compounds and nutrients. These constituents result from atmospheric deposition, traffic activities, vehicular wear, pavement degradation and deicing, landscape maintenance and littering. The nutrient load from the site is expected to vary seasonally.

REPORT OF MONITORING FOR SELECT WATER QUALITY PARAMETERS IN THE STORMWATER MANAGEMENT PONDS FOR A COMMERCIAL DEVELOPMENT. Michael L. Bass, Marion A. Cross and Leah N. Sumner. Earth and Environmental Sciences, University of Mary Washington, Fredericksburg, VA. In the 1990s the Silver Construction Company built Central Park in Fredericksburg, Virginia. In the process 6.9 acres of wetlands were destroyed and had to be reconstructed in compliance with section 404 of the Clean Water Act. In order to meet the requirements, storm water management ponds were built with the wetland benches around them within Central Park and a mitigation site was created along Massaponax Creek in Spotysylvania County. The purpose of this study was to monitor the storm water management ponds of Central Park. This background data will be used as preliminary info on nutrient loads in these ponds when the new DCR regulations are in place. Water quality monitoring was conducted on the storm water management ponds and the migrated wetland site. Dissolved oxygen, pH, temperature and conductivity were taken on site using a YSI model 85 field multimeter. Water samples were taken and brought back to the lab at the University of Mary Washington. The samples were tested for nitrates, phosphates, alkalinity and hardness. Testing was done on the same day as the

samples were taken. LaMotte test kits were used for each test, and the nitrate and phosphate levels were measured with a colorimeter. The storm water management ponds exhibited normal ranges in chemistry values, with high nutrient levels in the Best Buy, Kohl's and Upper Target ponds still not exceeding EPA maximum dose levels. These ponds also exhibit higher alkalinity and water hardness levels and are constructed with culverts of concrete that is weathering, which could contribute to the elevations. Preparations are being made to monitor rainwater and surface runoff prior to entering the stormwater management ponds.

Medical Science

A BIOMARKER PANEL FOR NON-ALCOHOLIC STEATOHEPATITIS (NASH) AND NASH-RELATED FIBROSIS. Zobair M. Younossi[1,2,3], Sandra J. Page[2,3], Nila Rafiq[1,2], Aybike Birerdinc[2,3], Maria Stepanova[1,2], Noreen Hossain[2], Arian Afendy[1,2], Zahra Younoszai[1,2], Zachary Goodman[4] & Ancha Baranova[1,2,3], [1]Center for Liver Diseases, Inova Fairfax Hospital, [2]Betty and Guy Beatty Center for Integrated Research, Inova Health System, Falls Church, VA, [3]Center for the Study of Genomics in Liver Diseases, Molecular and Microbiology Department, George Mason University, Fairfax, VA, [4]Armed Forces Institutes of Pathology, Washington, DC. Non-alcoholic Fatty Liver Disease (NAFLD) is one of the most prevalent forms of chronic liver disease worldwide. Patients with NASH and NASH-related fibrosis, both intermediate stages of NAFLD, are at increased risk for progressive liver disease. Liver biopsy is used to diagnose these stages but has inherent risks; thus, a non-invasive alternative is greatly needed. This study examines the performance of a new, serum-based biomarker panel for NASH and NASH-related fibrosis. Serum from patients with biopsy-proven NAFLD was assayed for markers associated with the pathology of NASH and fibrosis. Regression models predictive of NASH, NASH-related fibrosis and NASH-related advanced fibrosis were then designed and cross-validated. The resulting models had AUC values > 80%, indicating high sensitivity and specificity. Together, these models formed a biomarker panel for NASH and NASH-related fibrosis that had good performance and was easy to use. Further testing on larger populations is warranted.

EXPRESSION OF CYTOKINES AND GASTRIC PEPTIDES IN MORBIDLY OBESE PATIENTS WITH NON-ALCOHOLIC FATTY LIVER DISEASE. Amanda C. Zirzow[1,2], Michael Estep[2], Noreen Hossain[2], Zachary Goodman[2], Hazem Elariny[2], Vikas Chandhoke[1], Ancha Baranova[1,2] & Zobair M. Younossi[2], [1]George Mason University, Fairfax VA 22030 and [2]Betty and Guy Beatty Center for Integrated Research, Inova Health Systems, Falls Church. Non-alcoholic fatty liver disease (NAFLD) describes the spectrum of conditions ranging from simple steatosis, the accumulation of excessive intercellular fat in hepatocytes, to non-alcoholic steatohepatitis (NASH), which is marked by necroinflammation and hepatic fibrosis. Although simple steatosis is relatively benign, 10 to 15 percent of the population will progress to NASH. Currently, the only way to diagnose NASH or to assess the stage of fibrosis is by obtaining a liver biopsy, which is invasive, expensive, and associated with

potential risks. This lack of diagnostics is intolerable since NAFLD occurs in an estimated 25 to 30 percent of the US general population, and NASH is reported in 2 to 3 percent of the population. NAFLD is closely associated with obesity, a chronic inflammatory state. This study investigates the role of the gastric appetite regulating peptides Ghrelin and Obestatin as well as several inflammatory cytokines by measuring their expression in the context of NAFLD. Data generated by this work could have direct relevance to patient diagnosis and screening as well as advance scientific understanding pertaining to the complex regulation of appetite stimulation and suppression in the context of obesity related disease.

ALPHA-MELANIN STIMULATING HORMONE (α-MSH) AND MELANIN CONCENTRATING HORMONE (MCH) EXPESSION IN OBESITY AND OBESITY RELATED DISEASES. Massih Abawi[1,2], Michael Estep[2], Vikas Chandhoke[1], Zobair M. Younossi[2], & Ancha Baranova[1,2]. [1]George Mason University, Fairfax VA 22030 and [2]Betty and Guy Beatty Center for Integrated Research, Inova Health Systems, Falls Church. In humans, melanin is produced in melanocytes and a few other specialized cells of the body. Our lab has been the first to demonstrate that melanin biosynthesis pathway is functional in adipose tissue of morbidly obese subjects. Melanin biosynthesis is regulated by melanogenic peptides αMSH and MCH. The aim of this study was to assess circulatory levels of αMSH and MCH in morbidly obese patients with obesity related diseases. Clinical data and fasting serum samples were collected from 39 morbidly obese NAFLD patients at the time of the liver biopsy. All liver biopsies were interpreted by a single hepatopathologist and assessed for liver disease. Fasting serum was assayed for αMSH and MCH concentrations which were determined by sandwich ELISA. Cytokine concentrations were obtained by BioPlex Multi-plex assay. Circulating levels of MCH and αMSH displayed strong positive correlation ($r=0.76$, $p<0.001$). Concentrations of αMSH showed small but statistically significant positive correlations with IL-6 ($r=0.36$, $p<0.05$), and Kupfer cell inflammation ($r=0.385$, $p<0.05$). Circulating concentrations of MCH also showed positive correlations with IL-6 ($r=0.32$, $p<0.05$), and Kupfer cell inflammation ($r=0.35$, $p<0.05$). Circulating levels of MCH and αMSH significantly correlate with markers of inflammation and may participate in the pathogenesis of NAFLD.

A CALCINEURIN-DEPENDENT LOSS AND AN OVERGROWTH OF DENDRITIC SPINES AFTER TRAUMATIC BRAIN INJURY IN RAT. John N. Campbell, Brian Low, David R. Register, & Severn B. Churn, Dept. of Neurology, Virginia Commonwealth University, Richmond VA 23298. Traumatic brain injury (TBI) can cause cognitive dysfunction in the absence of cell death, likely due in part to changes in neuronal connectivity. Dendritic spines form most of the excitatory synapses in the brain, and thus are one measure of neuronal connectivity. A loss of dendritic spines has been reported after TBI in human tissue samples, but this effect and its underlying mechanisms have not before been examined in an experimental model. In the present study, a modified Golgi-Cox technique was used to investigate the effect of TBI on dendritic spines at 1 h, 24 h, and 1 wk after lateral TBI in the adult rat. Principal cell dendrites were sampled for spine density in layer II/III neocortex,

hippocampal CA1 and CA3, and dentate gyrus. By 24 h post-TBI, the density of pedunculated (thin or mushroom-shaped) spines had decreased by 30% in ipsilateral layer II/III neocortex ($p<0.05$; n=19), by 29% in ipsilateral CA1 ($p<0.001$; n=18), and by 23% in contralateral CA1 ($p<0.01$; n=12). Strikingly, this loss of spine density was prevented by a single, 1 h post-TBI administration of the calcineurin inhibitor, FK506. By 1 wk post-TBI in untreated subjects, dendritic spine density returned to control levels in some brain regions but increased above control levels in other regions (ipsi CA1; +52%, $p<0.001$, n=14; contra CA1; +43% , $p<0.001$, n=13; ipsi CA3; +34%, $p<0.01$, n=14; contra CA3; +25%, $p>0.05$, n=13). These data imply significant, bilateral changes in the synaptic circuitry of the laterally-injured brain. Research supported by Commonwealth Neurotrauma Initiative grant 07-302E to S.B.C.

HERMITAMIDE B: DISCOVERY OF A MARINE NATURAL PRODUCT SODIUM CHANNEL BLOCKER. Eliseu O. De Oliveira[1], Kristin M. Graf[1], Kan Wang[1], Sivanesan Dakshanamurthy[1], Milton L. Brown[1], Manoj K. Patel[2], & Mikell Paige[1], [1]Drug Discovery Program, Georgetown University, Washington DC 20057 and [2]Dept. of Anesthesiology, University of Virginia, Charlottesville VA 22908. Marine natural products have historically been an important source of new drugs. The cyanobacterium *Lyngbya majuscula* present in tropical and sub-tropical waters produce a range of cytotoxic secondary metabolites. The lipopeptide hermitamide B was isolated from *L. majuscula* collected from deep-water coral reefs at Hermit Island Village, in Papua New Guinea. Because of its structural similarity with the jamaicamides, a family of sodium channel blockers isolated from cyanobacterium, we hypothesized that hermitamide B would also behave as a sodium channel blocker. We were delighted to find in our initial *in vitro* screen that hermitamide B displaces [^{3}H]-BTX from sodium channels in a comparable manner with phenytoin (i.e. ~20%, at 10 μM), a clinically used sodium channel blocker. Subsequent electrophysiology experiments showed that hermitamide B significantly blocks the sodium current in HEK-293 cells that over express $Na_V1.2$ sodium channels (>80% blockade at 1 μM). Herein, we present our total asymmetric synthesis of hermitamide B, using three major strategies: Keck allylation for chiral center formation, Johnson-Claisen condensation to set the *E*-olefin, and carbodiimide assisted coupling of lyngbic acid with the appropriate amine to give the final product. Yield was 8% over 7 steps with a >95:5 er.

THE IDENTIFICATION OF NOVEL RAT NITRIC OXIDE SYNTHASE 1 FIRST EXONS MAY LEAD TO A BETTER UNDERSTANDING OF DIABETES. Robert L. Murphy, Divya Bansal, Robert Lera, & Terrie K. Rife, Dept. of Biol. James Madison Univ., Harrisonburg VA 22807. The misregulation of nitric oxide synthase I (*NOS1*) has been linked to type-2 diabetes. Due to the difficulty of obtaining human tissue and controlling for environmental influences, many researchers use the rat model to study transcriptional changes in *NOS1* during the pathogenesis of these diseases. However, the rat *NOS1* gene has not been completely characterized, which prevents us from understanding which promoters might be directing disease-related changes in *NOS1* expression. The better-characterized human *NOS1* gene has twelve first exons with associated promoters (1a -1l). The translation start site of the gene is found in the

second exon, which is common to each transcript resulting in the same functional protein. The rat *NOS1* gene has known orthologs to the human first exons 1b, 1c, 1f, and 1g. However, these exons and associated promoters alone do not explain the changes in *NOS1* expression that occur in rats with type-2 diabetes. Thus, rat orthologs to the other human first exons were hypothesized using genomics techniques. Two of the predicted first exons, orthologs to human 1h and 1k, were confirmed to initiate transcription in rats using reverse transcription, PCR, and Southern blotting and were then sequenced. The ortholog to human 1h was found to be expressed in the brain, intestine, kidney, retina and testis, but not in skeletal muscle, and the ortholog to first exon 1k was only expressed in brain. The next step of this research is to study how the transcription of these first exons is altered in diseased rats. This research was funded by a National Biological Honor Society research grant.

RESPONSIVE CHANGES TO NEONATAL GENISTEIN AND ESTRADIOL EXPOSURE IN THE POST-PUBERTAL MOUSE TESTIS AND EPIDIDYMIS: HISTOLOGICAL AND CELLULAR ANALYSIS. Nathan T. Derstine, Ben K. Ruth, & Roman J. Miller, Department of Biology, Eastern Mennonite University, Harrisonburg VA 22802. Effects of neonatal exposure to genistein or estradiol on the post-pubertal testis and epididymis were examined in Swiss mice,injected subcutaneously with control (no-hormone vehicle), estradiol (15µg / injection), or genistein (166µg / injection) every other day from post-natal day (PND) 2 through 14. Mice were necropsied on PND 39; testes and epididymides were prepared for histology. Compared with control, testis weights were reduced in genistein and estradiol groups by 19% and 39% respectively. Seminiferous tubules of genistein and estradiol mice had reduced percentage of tubular wall, total lumen space, and luminal spermatozoa compared to control. In the estradiol group the epididymis organ weightwas reduced by 43% from control and the mean tubular diameter was significantly increased by 7.3%. Spermatozoa counts were reduced by 74% in genistein-treated mice and were not found in the estradiol group. Numerous unusual cells were found in the epididymis tubular lumen of genistein mice. The unusual cells in the lumen are postulated to be immature sperm cells based on the herniated appearance of the seminiferous tubular wall and their close resemblance to primary and secondary spermatocytes. (Research supported in part by Daniel B. Suter Biology Program Endowment, Eastern Mennonite University.)

MURINE FERTILITY FOLLOWING NEONATAL EXPOSURE TO GENISTEIN AND ESTROGEN. Katrina J. Lehman, Jackson T. Maust, Brittany D. Kropf, Kristina R. Landis, and Roman J. Miller, Department of Biology, Eastern Mennonite University, Harrisonburg VA. To determine the effects of selected estrogens on the murine reproductive system, fertility assays were conducted following seven neonatal subcutaneous injections of control vehicle, genistein, or estradiol on postnatal days 2, 4, 6, 8, 10, 12, and 14. Experimental male mice (six control, four genistein, four estradiol) from the treatment groups were individually housed with non-injected control (NIC) female mice as young adults for ten days (postnatal days 58 through 68 ±2 days) to allow mating. Similarly, five control, five genistein, and five estradiol female mice

from the experimentally treated groups were individually housed with NIC male mice for the same time period to allow mating. After the ten days, male mice were removed from the cages. The numbers of mice per litter were recorded on the dates of parturition, about 21-25 days following the mating period. Litter weights and numbers were recorded again on days 15-19 following parturition. None of the injected males in the estradiol group produced any offspring. For the females, statistically significant reductions in fertility were observed in both the genistein-injected females and the estradiol-injected females, although one female mouse from each treatment group produced offspring. The genistein-injected male mice did not appear to have a significant reduction in fertility. Because phytoestrogens such as genistein are found in soy products, continued research is necessary to determine the effects of exposure on fertility and reproductive development. (Research supported in part by Daniel B. Suter Biology Program Endowment, Eastern Mennonite University.)

THE ROLE OF NEURONAL NICOTINIC ACETYLCHOLINE RECEPTORS IN THE ACUTE EFFECTS OF ALCOHOL. Anton J. Dawson, M. Imad Damaj. Department of Pharmacology and Toxicology, Virginia Commonwealth University, Richmond, VA. Tobacco and Alcohol are the two most commonly abused drugs in the world and there is high co-morbidity of addiction to these substances. Substantial evidence suggests that neuronal nicotinic acetylcholine receptors (nAChRs), the receptors to which nicotine binds, may contribute to certain aspects of alcohol dependence. Such evidence has been demonstrated *in vitro* and *in vivo* in animals and in genetic studies in humans. However, the underlying mechanisms of these interactions are still not well understood. Thus we initiated an investigation to uncover the specific nAChR subtypes involved in some of the many underlying mechanisms of ethanol-induced behaviors. We used a variety of approaches to investigate the modulating effects of nicotinic antagonists on such behaviors in C57BL/6J mice. The first approach was to study the acute effects of ethanol-induced loss of righting reflex (LORE), anxiolysis, and hypothermia. The results showed that the drugs Mecamylamine, Dihydro-β-Erythrodine, and Varenicline, in addition to knockout mice lacking the β2 subunit, significantly modulated sensitivity to the ethanol-induced LORE response. Varenicline also reduced ethanol-induced anxiolysis, while increasing sensitivity to the hypothermia response. In conclusion, we have added to data in the field suggesting the involvement of β2-containing nAChRs mediating some of the acute effects of alcohol. Future efforts will continue with additional antagonists and gene knockout mice to understand specific subunits including the largely unexplored α5 and α6 subunits and their relation to ethanol behaviors.

OPIOID AND GP-120 INTERACTIVE NEUROPATHOGENESIS IN HIV-1: ROLE OF CASPASE-3. Kimberly, L. Samano & Kurt F. Hauser. Department of Pharmacology and Toxicology, Virginia Commonwealth University, Richmond VA 23298. gp120, an HIV-1 coat protein, is an established neurotoxin and it is required for viral entry and infection, and its extracellular actions are toxic to microglia, astrocytes, and neurons. It is hypothesized that morphine will exacerbate gliosis and neuronal cell death caused by gp120 *in vivo* and this neuropathogenesis is proposed to occur through

a caspase-3 dependent mechanism. Studies will investigate the effect of morphine and HIV-1 on reactive gliosis of astrocytes and microglia via stereotaxic intrastriatal injection of gp120 into C57BL/6J and caspase 3 knockout (KO) mice. Gliosis will be assessed by co-localization studies performed via fluorescent microscopy probing for glial fibrillary acidic protein (GFAP) and μ opioid receptor as well as Iba_1 with 3-nitrotyrosine (3-NT for nitrosative stress). It is anticipated that μ opioid receptor expressing glia will be more vulnerable to insult versus cells lacking the receptor. Neuronal death will be verified by TUNEL assay to determine if morphine potentiates gp120-induced neuronal apoptosis and to explore if this effect can be alleviated through genetic deletion of caspase-3. Unexpectedly, preliminary results show that morphine administered to caspase-3 KO mice was lethal. This effect was abolished by pretreatment with naltrexone, strongly suggesting this interaction is opioid receptor mediated. Additional studies will be conducted to assess this novel finding and to investigate the mechanism(s) of morphine lethality. Collectively, these studies will add to the understanding of how morphine influences the neuropathogenesis of HIV-1 as well as explore the role of caspase-3 in this interactive comorbidity.

NAVIGATING THE MURKY WATERS OF NICOTINE AND ANXIETY: CONTRIBUTIONS OF THE ß2 SUBUNIT. Shawn M. Anderson & Darlene H. Brunzell. Virginia Commonwealth University School of Medicine, Richmond VA 23298. Nicotine, the primary psychoactive agent in tobacco, exerts its effects by binding to nicotinic acetylcholine receptors (nAChR) in the brain, with ß2 containing nAChRs (ß2*nAChRs) having the highest binding affinity for nicotine. ß2*nAChRs are significantly upregulated in the brains of smokers and rodents following extended exposure to nicotine. Although smokers report that they smoke to relieve anxiety, controlled studies suggest that repeated exposure to nicotine increases anxiety behavior. The purpose of these studies was to assess the role of ß2*nAChRs in anxiety-like behavior. Male ß2*nAChR knockout (?2KO) mice on a C57BL6 background and their wildtype (WT) counterparts were tested in a light-dark box assay after i.p. injection of 0, 0.01, 0.05, 0.1, or 0.5 mg/kg nicotine in 0.9% saline. ANOVA tests revealed a significant interaction of treatment and genotype for behavioral measures of latency and light-chamber exploration. WT animals that received 0.5 mg/kg nicotine showed significant increases in latency to leave dark chamber ($p < 0.05$) and decreases in locomotor activity in the light chamber ($p < 0.05$) compared to controls. These effects were not seen in ?2KO animals. These data suggest that ß2*nAChRs contribute to movement/exploratory behavior in an aversive environment. Consequently, it appears that ß2*nAChRs contribute to the anxiogenic effects of nicotine administration in the light-dark assay and suggest a potential mechanism for elevated anxiety behavior in smokers. This work was supported by a Jeffress Memorial Trust research grant J-951 and a NIDA small grant project award DA005274.

THE FULL AGONIST WIN55, 212-2 EXERTS GROWTH INHIBITORY EFFECTS THROUGH A CANNABINOID RECEPTOR INDEPENDENT MECHANISM. Sean M. Emery, David A. Gewirtz & Aron H. Lichtman, Virginia Commonwealth University, Richmond VA. Cannabinoids are known to inhibit the growth of a variety

of cancer cells in vitro, including those derived from glioma, breast, prostate, and lung tumors, among others. In the present study, we tested whether WIN55, 212-2 (WIN2), a synthetic cannabinoid that acts as a full agonist at both known cannabinoid receptors, CB_1 and CB_2, produces antiproliferative effects in both human (MCF-7 and MDA-MB-231) and murine (4T1) breast tumor cells. WIN2, but not its inactive stereoisomer WIN55, 212-3 (WIN3), elicited inhibitory effects on cancer growth, suggesting that these antiproliferative effects are due to the drug acting at a specific site of action. Interestingly, the highly selective CB_1 and CB_2 antagonists, Rimonabant and SR144528, respectively, did not block the effects of WIN2, either alone or in combination. Instead, each cannabinoid receptor antagonist enhanced the growth-inhibitory actions of WIN2 in each cell line. Both CB_1 and CB_2 are G protein coupled receptors (GPCRs), predominantly activating Gi/Go subtypes. Accordingly, we tested whether pertussis toxin, which inhibits Gi/Go proteins, would prevent WIN2's antiproliferative actions, but the treatment was unable to prevent WIN2's actions in any of the breast cancer cell lines. Taken together, these data suggest that WIN2 inhibits breast cancer cell growth through a non-GPCR mechanism of action, but the stereoselective-dependent nature of this effect suggests specific site(s) of action. Experiments are currently underway to determine the underlying mechanism of action for the antiproliferative effects of WIN2.

MODULATION OF GLIAL FUNCTION BY MORPHINE AND THE HIV-1 PROTEIN GP120. Elizabeth M. Podhaizer & Kurt F. Hauser, Dept. of Pharmacology and Toxicology, Virginia Commonwealth Univ., Richmond VA 23298. Opioid abuse, through injection drug use is tightly linked to HIV-1 infection through both the spread of the disease and by exacerbation of disease progression culminating in HIV-1 encephalitis (HIVE) and neurocognitive impairments. CNS glia are intimately involved in the dual effects of opioids and HIV-1, as glia, unlike neurons, are infected by HIV-1 and additionally release inflammatory and modulatory substances that can activate neighboring glia as well as interfere with neuronal function. Previous work has shown that astrocytes are directly involved in morphine's toxicity. Thus, we hypothesized that opioids acting directly through astrocytes, dysregulate glial function and lead to interactive neurotoxicity in the presence of HIV-1 infection. To address this hypothesis, we examined important convergent signaling events of two $G_{i/o}$ coupled receptors, MOPr and CCR5, the receptors for morphine and the envelope glycoprotein, gp120 respectively. Opioids and HIV-1 proteins elevate intracellular ROS in astrocytes as well as promote increases in intracellular calcium levels independently, which are linked to inflammatory signaling. Morphine, but not gp120 altered p-ERK levels with morphine decreasing p-ERK over a 60 minute period, suggesting that opioids impair the proliferative function of astrocytes. Additionally, agonist selectivity is present between gp120 and the endogenous ligand to CCR5, RANTES which elevated p-ERK over 60 minutes. These results suggest that signaling through opioid and chemokine receptors by morphine and gp120 have similar points of convergence where interactive signaling will be examined.

ARTEMIS ENDONUCLEASE: A CRITICAL REINFORCEMENT TO THE G1 DNA REPAIR ARMAMENT. Susovan Mohapatra[1], L.F. Povirk[1], Imran Khan[2], M.K.Stillion[2] & S.M. Yannone[2], [1]Dept. of Pharmacology and Toxicology, Virginia Commonwealth University, Richmond Va and [2]Dept. of Genome Stability, Lawrence Berkeley Laboratory, Berkeley, Ca. DNA double strand breaks (DSB) are the most significant lesions resulting from radio/chemotherapeutic intervention of cancer. Nonhomologous end-joining (NHEJ) is considered to be a critical DNA repair pathway and mutations in the NHEJ factor Artemis have been implicated in radiosensitive severe combined immunodeficiency (RS-SCID) or Athabascan SCID in humans, as well as increased risk of lymphoma in some settings. Prior *in vitro* studies showed that Artemis has a DNA-PK-dependent endonuclease activity at DNA ends. To assess the possible role of this endonuclease activity in chemo/radioresistance, patient-derived Artemis-deficient CJ179 fibroblasts were stably complemented with lentiviral vectors expressing either wild-type or D165N Artemis, a mutation that eliminates its endonuclease activity. As determined by clonogenic survival assays, expression of wild-type Artemis but not D165N mutant conferred approximately two-fold resistance to ionizing radiation, as well to the radiomimetic agents bleomycin and neocarzinostatin in CJ179 cells. Measurements by γ-H2AX, 53BP1 focus formation and pulse-field gel electrophoresis (PFGE) assays suggested a repair defect (10-20%) in Artemis-deficient and D165N Artemis mutant cell lines, but not in wild-type Artemis-complemented cells, particularly at 6-18 hr post-irradiation. These results, combined with previous *in vitro* studies, suggest that resolution of terminally blocked DNA ends by the endonuclease activity of Artemis may be its biologically relevant function.

GENOMIC ANALYSIS OF THE ETHANOL DEPRIVATION EFFECT. Jonathan A Warner & Michael F. Miles, Department of Pharmacology and Toxicology, Virginia Commonwealth University, Richmond, VA. The potential for relapse into abusive modes of substance use is of paramount concern in recovery from any type of substance addiction. Alcoholism presents significant challenges to the addict due to its strong heritability and the pervasive legal availability of alcohol in most industrialized societies. The ethanol deprivation effect (EDE), also known as the alcohol deprivation effect, models relapse behavior of human alcoholics, and manifests in mice as an increase in ethanol consumption and preference following forced abstinence, which is attenuated by naltrexone and acamprosate. Several transcripts previously identified by microarray analysis of nucleus accumbens as significantly regulated by ethanol deprivation were confirmed with quantitative PCR. These transcripts code for proteins involved in a diverse range of cellular functions, including calcium regulation, mitochondrial localization, RNA interference, and chromatin modification. Because repeated deprivations have been shown to increase the magnitude of the EDE, a long-term "binge" model with repeated deprivations was used to obtain further samples for genomic analysis. After one month of habituation and one month of uninterrupted ethanol access the mice were subjected to eight cycles of six days of ethanol deprivation followed by one day of reinstatement. This model produced a significant and sustained increase in ethanol consumption and preference for ethanol over water following the

first deprivation period, and it should prove useful in further exploration of the molecular mechanisms of both development and maintenance of the EDE, as well as in testing long-term efficacy of therapeutics for alcoholism.

PAIN-RELATED DEPRESSION OF INTRACRANIAL SELF-STIMULATION IN RATS: EFFECTS OF THE DELTA OPIOID AGONIST SNC80 AND THE PSYCHOMOTOR STIMULANT COCAINE. Marisa B. Rosenberg[1], John E. Folk[2], Kenner C. Rice[2] & S. Stevens Negus[1], [1]Deparment of Pharmacology and Toxicology, Virginia Commonwealth University, Richmond VA; [2]Chemical Biology Research Branch, NIDA/NIAAA, Rockville, MD. Pain is associated with a stimulation of some behaviors (e.g. withdrawal responses) and a depression of other behaviors (e.g. feeding, locomotion, responding maintained by many types of positive reinforcement). We have argued that analgesic drug development may benefit from complementary evaluation of drug effects on both pain-stimulated and pain-depressed behaviors. In this study, intraperitoneal injection of dilute lactic acid (1.8% in a volume of 1ml/kg) was used as a noxious stimulus in rats to stimulate a stretching response and to depress intracranial self-stimulation (ICSS) of the median forebrain bundle. The delta opioid agonist SNC80 (1-10 mg/kg, i.p.) dose-dependently blocked both acid-stimulated stretching and acid-induced depression of ICSS without altering control ICSS in the absence of the noxious stimulus. In contrast, cocaine (1-10 mg/kg i.p.) blocked acid-induced depression of ICSS only at doses that also facilitated control ICSS, and cocaine had no effect on acid-stimulated stretching. Flupenthixol (0.01-1 mg/kg, i.p.) blocked acid-stimulated stretching but also decreased control ICSS and only exacerbated acid-induced depression of ICSS. Thus, the antinociceptive effects of SNC80 could be dissociated from the non-selective stimulant effects of cocaine and the non-selective depressant effects of flupenthixol. Supported by NIH grants RO1-DA11460 and R01-NS070715.

ROLE OF INSULIN RESISTENCE IN PCOS AND IMPLICATIONS FOR DEVELOPMENT OF METABOLIC SYNDROME AND HEPATOSTEATOSIS. Aybike Birerdinc[1,2], Nandita Niranjan[1], Noreen Hossain[2,3], Arian Afendi[2,3], Vikas Chandhoke[1,2], Ancha Baranova[1,2] & Zobair Younossi[1,2,3], [1]Molecular and Microbiology Dept. and Center for the Study of Genomics in Liver Diseases, George Mason Univ., Fairfax, VA 22030, [2]Translational Research Institute, Inova Health System, Falls Church, VA 22042 and [3]Center for Liver Diseases, Inova Fairfax Hospital, Falls Church, VA 22042. Polycystic ovarian syndrome is a common disorder observed in women aged mainly in the reproductive age bracket: from 12- 45 years. PCOS is also associated with a number of other pathological features such as obesity, insulin resistance, and disregulation in lipid metabolism. In this study we attempt to determine the genetic commonalities between PCOS and NAFLD as both disorders have the hallmarks of Metabolic Syndrome. For this study 12 patients with diagnosed PCOS and 12 patients with confirmed lack of PCOS were selected. The two cohorts were carefully matched for clinical parameters such as presence of liver disease, BMI and age. These cohorts will be profiled by qPCR arrays to determine gene expression, by ELISA assays

to determine protein abundance, and microRNA panels to determine the involvement of microRNA's.

POSTERS

THE INDUCTION OF HEAT SHOCK PROTEIN 72 AT SPECIFIC HYPOTHERMIC INTERVALS IN AN ISOLATED AND PERFUSED RAT HEART MODEL-IMPLICATIONS FOR CARDIAC TRANSPLANTATION. E. Taylor[1], I. Danelisen[1], V. Sivakumaran[2], J.E. Mahaney[1,2], R.P. Wyeth[1], [1]Via College of Osteopathic Medicine, Virginia Campus, Blacksburg VA 24060 [2]Virginia Polytechnic Institute and State University, Blacksburg VA 24060. Maintaining cardiac viability is a significant determinate in, and limitation to, cardiac transplantation. Current technology restricts the use of donor hearts due to increasing injury suffered to explanted hearts as time to implantation increases. Thus, the time span from procurement to implantation is greatly limited (~4 hours). Heat shock proteins (HSPs) contribute to cellular survival. Understanding HSP's role in cooling and rewarming of explanted hearts may increase the allowable time from explantation to implantation by protecting vital cardiac proteins from denaturation during transplantation. To test this hypothesis, male and females rat hearts were cannulated, stabilized, and perfused for 30 min at target temperatures. Caspase and HSP 72 were quantitated from myocardial homogenates. Myocardial injury, as caspase expression, was greater at the extremes of thermal stress as was myocardial protection, as HSP 72 expression. Furthermore, females expressed significantly more HSP 72 than males at hypothermic conditions. Our preliminary data suggest that HSP 72 is induced by thermal stress and that females are more capable of preventing protein denaturation at hypothermic conditions than are males.

A RETROSPECTIVE STUDY OF THE DISPARITY OF HEALTHCARE IN SOUTHWEST VIRGINIA BASED ON THE PRESENTATION OF ACUTE MYOCARDIAL INFARCTION AND ASSOCIATED MORTALITY IN PATIENTS LESS OR EQUAL TO 50 YEARS OF AGE. E. Taylor[1], J. Powers[1], R.P. Wyeth[1], National Center for the Analysis of Healthcare Data[1], Laboratory for Interdisciplinary Statistical Analysis[2], [1]Via College of Osteopathic Medicine, Virginia Campus, Blacksburg VA 24060, [2]Virginia Polytechnic Institute and State University, Blacksburg VA 24060. Patients 50 years or less of age from southwestern (SW) were compared to patients residing in the remaining health districts of Virginia presenting with initial myocardial infarction (MI) with and without mortality. A total of 2280 patients were identified. The prevalence of initial nonfatal MI was 48.9/100K in SW Virginia and 37.7/100K in the rest of the Commonwealth. The prevalence of fatal MI was 7.0/100K in SW Virginia and 2.6/100K in the rest of the state. Neither prevalence of fatal nor nonfatal initial MI was statistically significant when SW Virginia patients were compared to patients from the remaining Commonwealth. There were however significant differences within mean household income and the population density. The mean income was $55,846 in SW Virginia as compared to $81,235 in the remaining Commonwealth, while the population density was 95 persons/1000 sq mile within SW Virginia and 258 persons/sq mile within the remaining Commonwealth.

Natural History & Biodiversity

REMOVAL OF MAMMALIAN PREDATORS REDUCES PREDATION RATE ON ARTIFICIAL BEACH-NESTS ON THE VIRGINIA BARRIER ISLANDS. Raymond D. Dueser[1,2], Joel D. Martin[2], Nancy D. Moncrief[1] & John H. Porter[3], [1]Virginia Museum of Nat. Hist., 21 Starling Ave., Martinsville, VA 24112, [2]Dept. of Wildland Res., Utah State Univ., Logan, UT 84322, [3]Dept. of Env. Sci., Univ. Virginia, Charlottesville, VA 22903. We compared predation rates on eggs in artificial scrapes on (1) Metompkin and Parramore islands in August 2003 and on (2) Parramore Island before (2003) and after (2004) an intensive campaign to remove mammalian predators. On each island, we established 100 scrapes at randomly-selected points along a 4-km transect oriented parallel to the beach, above the high tide line. Each scrape was stocked with a "clutch" of 1 Japanese quail egg and 1 clay (Plasticene) egg. Each nest was monitored and restocked daily for 4 days. Metompkin was thought to be free of raccoons and red foxes in 2003, while Parramore harbored large numbers of both species. Mammalian predation rates were higher on Parramore (~99% per day) than on Metompkin (~0%). Nevertheless, gulls and ghost crabs depredated ~19% of the nests per day on Metompkin. We repeated this trial in 2004, using the same nest stations. Metompkin harbored 1-2 raccoons at this time, while Parramore still harbored both species even after a large number of raccoons and red foxes had been removed in autumn 2003. Mammalian predation rates on Parramore (18% per day) were still higher than on Metompkin (~0% per day), but were reduced dramatically from 2003. Once again, gulls and ghost crabs depredated ~6% of the nest per day on Metompkin. These results suggest that mammalian predation management has significant potential for reducing nest predation on islands.

THE BIRDS IN BETWEEN: PRODUCTIVITY OF EARLY SUCCESSIONAL BIRDS IN THE VIRGINIA PIEDMONT. Erica M. Rutherford[1], Mark L. Fink[1], Alix D. Fink[1], & Michael D. Collins[2], [1]Dept. of Biological and Environmental Sciences, Longwood University, [2]Dept. of Biology, Hampden-Sydney College. Some early-successional species listed as being of global conservation concern, including the Prairie Warbler (*Dendroica discolor*), occur at high abundances in the Virginia Piedmont. Effective stewardship of those species requires understanding of how they are affected by management activities in the landscapes. We examined factors affecting reproductive success in a suite of six early successional species inhabiting in a variety of managed regenerating forests. In three seasons (2004, 2005, 2008), we located a total of 178 nests of the species suite: Prairie Warbler, Yellow-breasted Chat (*Icteria virens*), Field Sparrow (*Spizella pusilla*), Eastern Towhee (*Pipilo erythrophthalmus*), Indigo Bunting (*Passerina cyanea*), and Brown Thrasher (*Toxostoma rufum*) (and others; 10 species in total). Additionally, we measured habitat variables at two spatial scales: nest site and habitat patch. Simple nest success was 47% overall, with rates for focal species ranging from 53% for Yellow-breasted Chat (24 of 45) to 13% for Eastern Towhee (2 of 15 nests). Parasitism by Brown-headed Cowbirds (*Molothrus ater*) was relatively uncommon, occurring in 8% of total nests. Further analyses will use an

Information Theoretic Approach to evaluate factors influencing nest success, and survival models will be used to determine rates of daily survival. However, these preliminary estimates of simple nest success provide insights into the productivity of birds in these regenerating sites, as abundance is often the only indicator cited in their valuation.

DIVERSITY OF NON-*APIS* BEES IN SOUTHWEST VIRGINIA CROP LANDS. Nancy L. Adamson, Donald E. Mullins & Richard D. Fell, Entomology Dept., Virginia Tech, Blacksburg, VA 24061. Native bees provide the majority of crop pollination for some crops in the mid-Atlantic region. Little is known about native bee crop pollinators in Virginia, other than squash, bumble, and mason bees. This presentation highlights the abundance and diversity of non-*Apis* bees pollinating apples, blueberries, caneberries, and cucurbits in southwest Virginia during the 2008 and 2009 growing seasons, including six state records--*Bombus sandersoni* Franklin, 1913; *Coelioxys rufitarsis* Smith, 1854; *Holcopasites calliopsidis* (Linsley, 1943); *Lasioglossum apocyni* (Mitchell 1960); *Melissodes communis* Cresson, 1878; and *Triepeolus simplex* Robertson, 1903. As part of an on-going monitoring effort managed by the U.S. Geological Survey, the research provides baseline data to understand long-term population trends and to enhance land and farm management based on relationships between bee species richness and vegetation surrounding farm land. (Supported by a pollination research grant to the Virginia Cooperative Extension from the Virginia General Assembly and by the Virginia Tech Graduate Student Assembly's Research and Development Program and Travel Fund.)

SURVEY OF LOTIC DRAGONFLY SPECIES OF HANOVER COUNTY, VA. Allyson Lackey[1] & Leigh Adams[2], [1]Biology Department, Virginia Commonwealth University, Richmond, VA 23298, [2] Biology Department, J. Sargeant Reynolds Community College, Richmond, VA 23285. Authors report as many as 27 lotic species might be found in this county. The collection and identification of adult dragonfly species (Odonata) found in the lotic areas of Hanover County, Virginia was conducted to verify the dragonflies found in this location. Preliminary field collections were made from two different rivers (Pamunkey and the South Anna) systems within Hanover County; one on each side of the county, occurring during the months of June through July in 2009. Adults of *Anax junius, Gomphus lividus, Gomphus vastus, Arigomphus villosipes, Stylurus amnicola, Dromogomphus spinosus, Progomphus obscures, Libellula Lydia, Libellula vibrans, Libellula pulchella, Libellula incesta,* and *Libellula cyanea* were collected and verified on the surveyed streams of Hanover County, Virginia, the summer of 2009.

SMALL MAMMALS FROM A CLOUD FOREST IN THE MONTAÑAS DE CUILCO, HUEHUETENANGO, GUATEMALA. John O. Matson[1], Walter Bulmer[2], Ralph P. Eckerlin[2], Hayley Lanier[3] & Neal Woodman[4], [1]Dept. of Biol. Sci., San Jose State Univ., San Jose, CA 95192, [2]Division of Nat. Sci., Northern Virginia Community College, Annandale, VA 22003, [3]University of Alaska Museum, Univ. of Alaska, 907

Yukon Dr., Fairbanks, AK 99775, [4]USGS, Patuxent Wildlife Research Center, National Museum of Nat. Hist., Smithsonian Institution, Washington, DC 20013. We surveyed the remnant mixed hardwood/coniferous cloud forest at elevations ranging from 2950m to 3160m at El Retiro, in the isolated Montañas de Cuilco, Huehuetenango, western Guatemala. Removal trapping for 4 days each in July 2008 (wet season) and January 2009 (dry season) resulted in 106 captures representing 6 species of shrews and rodents. This diversity of small mammals is the lowest that we have recorded from a Guatemalan cloud forest, compared to 10-15species at other localities. Based on capture rates, the species in order of relative abundance in the small mammal community are *Peromyscus beatae sacarensis* (n=45), *P. guatemalensis* (n=34), *Reithrodontomys microdon* (n=9), *R. sumichrasti* (n=7), *Sorex saussurei* (n=6) and *R. mexicanus* (n=5). The low species diversity may result from habitat destruction by recent large-scale fires and by logging for firewood and lumber. Habitat loss may have direct effects, but also leads to fragmentation that may restrict reinvasion after fire. This represents the first collection of small mammals from this mountain range.

Psychology

GENDER, ETHNICITY, & ORGAN DONATION. Daniel Baughn[1], Stephen M. Auerbach[1], & Laura A. Siminoff[2]. [1]Department of Psychology, Virginia Commonwealth University, Richmond, VA 23284 and [2]Department of Social & Behavioral Health, Virginia Commonwealth University, Richmond, VA 23298. Understanding the factors that influence the procurement coordinator (PC) and the family at the time of organ donation may be one way to increase the rate of donation. Using an analogue format, this study examined the interpersonal behavior of PCs and simulated families during the donation request process. Interpersonal processes were assessed using behavioral ratings by independent observers using the Impact Message Inventory (IMI), the Participatory Style of Physician Scale (PSPS), and the Siminoff Communication Content and Affect Program (SCCAP). Three-way ANOVAs were conducted to evaluate the effects of gender of PC, ethnicity of PC, and ethnicity of family on the interactional variables. There was a significant PC gender × scenario (scn) interaction effect on IMI Affiliation, $F(1,25)= 6.65$, $p<.02$. There was a significant PC gender × ethnicity interaction effect on IMI Control, $F(1, 25)=4.68$, $p<.04$. There was also a significant PC gender × ethnicity interaction effect on the Shared Decision Making subscale of the PSPS, $F(1,25)=5.83$, $p<.02$. There was a significant PC ethnicity × scn interaction effect on the Positive Affect scale of the SCCAP, $F(1, 25)=5.52$, $p<.03$. Implications for the field of organ donation and the training of procurement coordinators are discussed.

IMPACT OF EMOTIONAL AROUSAL AND SECONDARY TASK MODALITY ON PERFORMANCE. Rachel R. Phillips & Poornima Madhavan, Dept. of Psych, Old Dominion University, Norfolk VA 23529. In order to examine the effect of different modality distractors (visual or auditory) of differing affect (positive or neutral) on performance participants completed a luggage screening task with and without a secondary task in one of four conditions (positive-visual, positive-auditory, neutral-

visual, neutral-auditory). In the auditory condition, positive affect was induced with Irish drinking songs and neutral was attained using Native American Drum music; for the positive-visual condition the lyrics were transcribed and in the neutral-visual condition symbols were substituted. 2 (distraction: present vs. absent) x 2 (affect: positive vs. neutral) mixed ANOVAs for hit rate (H), false alarm rate (FA), and confidence (C) in the auditory and visual conditions revealed that participants in the auditory condition had fewer false alarms when distracted versus undistracted. This indicated that participant performance improved as participants were less likely to incorrectly identify a target. In contrast, participants in the visual condition demonstrated a decrease in hits indicating that they were less likely to correctly detect a target. Between-subjects ANOVAs for H, FA, and C when distracted in the auditory condition revealed no significant differences between the positive and neutral conditions. Similarly, 2 (modality: visual vs. auditory) x 2 (affect: positive vs. neutral) between-subjects ANOVAs for H, FA, and C indicated no significant differences between any of the conditions. Results suggest that music is beneficial to visual search performance when compared to no stimulation. However, performance while distracted did not vary as a result of affect or modality.

INTENTIONAL FORGETTING OF AUTOBIOGRAPHICAL MEMORIES IN UNIVERSITY STUDENTS: THE IMPACT OF PERSONAL RELEVANCE ON THE DIRECTED FORGETTING EFFECT. Tiffany M. Steinhagen & Elaine M. Justice, Dept. of Psychology, Old Dominion University. This study examined the effect of personally relevant information on the directed forgetting of autobiographical memories. College and neutral-themed words were presented to an undergraduate population in conjunction with the Motivation Scale Learning Questionnaire. The degree to which a student's internal motivation for academic success influenced the directed forgetting effect was examined. Participants showed greater recall of college-themed words than neutral-themed words. Results indicated that individuals with high motivation were less likely to forget college-themed words under the forget instruction.

EXAMINING DISCREPANCIES BETWEEN STATED AND REVEALED PREFERENCES DURING INTERNET SEARCH. Molly M. Liechty & Poornima Madhavan, Old Dominion University, Norfolk VA 23529. Using an eye tracker we examined decision-making processes during an internet search task. Specifically, we studied the intrinsic factor of gender and extrinsic aspects of a website (or, negative externalities). Twenty-five undergraduate students browsed a simulated real estate website where they viewed photographs of ten houses, each with six rooms. We manually altered four homes to reveal Level 1 externalities (or, properties that can easily be changed) such as pink paint on the wall, and Level 2 externalities (or properties that cannot easily be changed) such as power lines in front of the house. The relationship between "stated preferences", or preferences that are verbalized, and "revealed preferences," or preferences that are revealed from an actual decision was analyzed as a function of negative externalities and participants' gender. Average dwell times, fixation durations/counts, and saccade counts/amplitudes were compared to participants' stated preferences on general and home specific surveys. Results revealed

that men demonstrated a more aggressive search pattern than women, with a greater number of saccades with shorter saccade amplitudes for the former. Data also suggested that a discrepancy exists between stated and revealed preferences. Although participants initially stated that they disliked a room, their eye movement indices did not reflect this trend indicating that subjective verbalizations were discrepant from actual internet search patterns.

FOR WHOM THE BELL TOLLS: ACADEMIC BEHAVIORS, SELF-REGULATION, AND PACED DRINKING IN ACOA AND NON-ACOAS. Gabrielle M. D'Lima & Michelle L. Kelley, Department of Psychology, Old Dominion University, Norfolk, VA 23529. The present study examined whether meeting criteria for being the adult child of an alcoholic (ACOA) explained differences in alcohol consumption and consequences experienced by college students (N = 127) during their first semester. Further, this research sought to identify possible mediators (i.e., past-hedonistic time orientation, future time orientation, self-pacing, alcohol interference with academic behaviors and general self-regulation) that weaken the direct relationship between ACOA status and alcohol consumption and alcohol consequences. Multiple hierarchical regressions were conducted to determine if ACOA status would explain additional unique variance in alcohol consumption and consequences beyond the mediating factors. ACOA status remained a significant predictor of alcohol consumption and consequences even after accounting for variance explained by the pertinent mediators. These results extend previous research by indicating the importance of variables that may mediate the relationship between ACOA status and alcohol use and alcohol-related consequences. Additionally, these results suggest that rather than simply comparing drinking outcomes in ACOAs as compared to non-ACOAs, it may be necessary to identify specific behaviors that may result in increased drinking behavior.

HERPES STIGMA ATTITUDES IN COLLEGE UNDERGRADUATE STUDENTS. Anna K. Harrington & Valerian J. Derlega, Dept. of Psychology, Old Dominion University, Norfolk, VA. Approximately one in five people in the United States has genital herpes. Previous research conducted with college student participants showed that those with more general knowledge concerning the disease were less likely to hold negative attitudes toward persons infected with genital herpes. Using the 10 item Rosenberg Self-Esteem scale (r = .85), the author found no interaction between self-esteem and negative attitudes concerning herpes. While the correlation between knowledge of genital herpes and more accepting attitudes towards persons with genital herpes was supported (p = .037), there was no correlation between negative attitudes and self esteem (p = ns).

THE INFLUENCE OF HIGHLY EMOTIONAL FACES ON THE ATTENTIONAL BLINK. Brittany N. Pizzano & Hilary E. Stebbins, Dept. of Psych., Virginia Wesleyan College, Norfolk VA 23502. The anger superiority effect demonstrates that angry faces capture attention and are identified more quickly relative to happy and neutral faces. Little is known, however, regarding the extent and duration of the attentional capture

of angry faces. The present study utilized an attentional blink paradigm in which participants were asked to identify two emotional target stimuli (e.g. female faces) out of a series of neutral distracter stimuli (e.g. male faces). The emotional expression of the first target was manipulated (happy, angry, or neutral) and it was predicted that greater attentional capture by the angry face would result in lower ability to process and identify the second target, resulting in an attentional blink. A total of 36 undergraduate students (28 female, 8 male) participated in this study. Analyses revealed an effect of both gender and emotion of the target stimuli. Happy faces produced the largest attentional blink for both male and female target trials. Angry faces were also found to produce an attentional blink for male but not female targets. These results suggest that greater attentional capture may result from general emotional arousal rather than a threat or negativity bias and that target gender is an important factor in processing facial expressions of emotion. This study was funded by the Virginia Academy of Science.

PSYCHOLOGY FOR NATIONAL SECURITY: IMPLEMENTING PSYCHOLOGICAL PRINCIPLES TO IMPROVE TRAINING OF AIRPORT SECURITY SCREENERS. Poornima Madhavan, Department of Psychology, Old Dominion University, Norfolk, VA 23529. This research examined the hypothesis that stimulus diversity during training can positively influence transfer of learning in complex tasks such a luggage-screening. Participants (n = 48) detected the presence of threat objects in x-ray images of airline passenger luggage. Training stimuli varied as a function of (1) categorical diversity (few vs. several categories of threat objects), and, (2) exemplar diversity (few vs. several exemplars within each category). Participants transferred this learning to a scenario where they encountered novel targets. High categorical diversity led to highest hit rates, fewest false alarms and fastest detection during transfer, which was not significantly influenced by exemplar diversity. However, high exemplar diversity negatively impacted transfer when categorical diversity was low, leading to the fewest hits and slowest response times. The results have implications for designing training modules for luggage-screening personnel in a manner that capitalizes on natural human cognition.

EXPLORING THE ASCH PARADIGM: POPULATION VALIDITY, THE SEX DIFFERENCE, STIMULUS CLARITY, AND CONTEXTUAL INFORMALITY. James P. O'Brien, Tidewater Community College, Virginia Beach VA 23453. This pilot study replicates Asch's (1951, 1956) independence-conformity paradigm with modifications to identify topics favorable for fuller empirical exploration. Initial analyses (i.e., stimulus clarity/ambiguity) were reported at the Academy's annual meeting by Schwabenbauer, Schwabenbauer, Larkin & O'Brien in 1999. Further analyses indicate a number of unresolved issues: (1) With samples more representative of the adult Americans, evidence for population validity is weak; (2) Contrary to the literature, there is scant evidence for a significant sex difference in independence-conformity; (3) Contextual informality (i.e., peer experimenters) merits further study; (4) Since the "Asch dilemma" is predicated on stimulus clarity, the finding of stimulus ambiguity in control treatments for both men and women supersedes all other factors

in importance. Since independent control replications are infrequent in the literature, especially for female baselines, systematic investigation of stimulus clarity in Asch-type paradigms is urgently needed before other issues can be adequately tested and resolved.

SPATIAL NAVIGATION AND LATENT LEARNING IN FEMALE *BETTA SPLENDENS* USING FOOD REINFORCEMENT. Casey Beatley, Raluca Brand & Andrew Velkey, Department of Psychology, Christopher Newport University, Newport News VA 23606. *Betta splendens* are exploratory predators within their native habitat. However, male *Betta* are residential and search for prey within a territory, whereas female *Betta* are non-residential and explore larger areas in search of potential mates and prey. In order to locate and identify a suitable mate, female *Betta* must navigate male territories while also foraging for prey. Latent learning occurs when changes in performance are not immediately observable after experience. Are *Betta* capable of latent learning, and do females learn their explored environments even when prey or mates are not encountered? In the present study, a single subject design with multiple replicates, 6 female *Betta* were placed in a complex maze containing two choice points and multiple alleys. Three of the subjects received food reinforcement for maze completion on every trial. The other 3 fish explored the maze freely for a period of 8' during each of the first 17 trials. The free-roaming fish later received reinforcement on trial 18. Results showed that the roaming fish demonstrated stability in maze completion more quickly than always-rewarded fish. While the present study revealed evidence of latent learning, excessive variability masked the effect. Future research should utilize a simpler maze to better demonstrate this effect.

DEVELOPMENT OF A COMPUTERIZED IMAGE ACQUISITION SYSTEM FOR ANALYSIS OF *BETTA SPLENDENS* BUBBLE-NESTING BEHAVIOR. Raluca Brand[1], Casey Beatley[1], Christine Searles[1], Brian Roller[2], & Andrew Velkey[1], [1]Dept. of Psych., Christopher Newport University, Newport News VA 23606 and [2]Dept. of Psych., The University of Arizona, Tucson AZ 85721. The present study demonstrates a computerized method for quantifying bubble nest size in male *Betta splendens*. Bubble nesting is a reproductively relevant behavior in *Betta splendens*. Certain environmental variables may influence bubble-nesting behavior, and investigators may wish to examine more closely the factors related to the presence and quality of bubble nests. In order to further study factors associated with bubble nesting, the development of a reliable methodology to measure various parameters of bubble nests is necessary. Several improvements to the procedure and apparatus were implemented in the current methodology in order to further increase the accuracy of image analysis. One major improvement in image acquisition results from using new equipment such as a Canon EOS 50D SLR Digital Camera. Images are captured using a RAW lossless format at 15.1 megapixels resolution. Higher resolution image acquisition results in better image analysis. Furthermore, a polarized filter was used in order to reduce glare. The current experiment aims to reduce measurement error that previously resulted from similarities in color intensity between bubbles and objects reflected due to glare. Results are discussed in regards to opportunities for refinement of measurement technique and application of the newly improved methodology.

THE RELATIONSHIP BETWEEN BIRTH ORDER AND IPIP BIG-FIVE FACTOR MARKERS. Laura A. Boettcher & Gayle T. Dow, Ph.D. Dept. of Psychology, Christopher Newport University, Newport News, VA, 23606. The purpose of this project is to investigate how one's birth order (only, youngest, middle, and oldest) potentially impacts scores of the IPIP Big-Five Factor Markers. Traits such as extraversion, agreeableness and neuroticism can be swayed by birth order. Birth order researchers have found that common traits exist within only, oldest, middle, & youngest born individuals, specifically first-borns tend to be more conscientious, whereas later-borns tend to be more agreeable. An online survey was completed by 192 participants with questions regarding participants' birth order and 50 questions from the IPIP. The IPIP Personality measure considers questions using the Big 5 personality model-extraversion, agreeableness, neuroticism, openness & conscientiousness. It was hypothesized that the youngest-borns would score higher on the agreeableness and openness. Trends emerged for extraversion and neuroticism.

STIMULUS DISCRIMINATION DURING AN INSTRUMENTAL LEARNING TASK IN *DANIO RERIO*. *Morgan A. Cote-Coble & Christina Philyaw, Dept. of Psychology, Christopher Newport University, Newport News VA 23606.* Using an instrumental choice procedure, 12 zebrafish (*Danio rerio*) were tested for their ability to discriminate between a stimulus associated with food reward (S+) and a stimulus associated with no food reward (S-). The subjects swam to the end of a T-maze and made a choice between two distinctly colored arms. Two squads of 6 fish were tested. For 6 of the subjects, the blue arm served as the S+ and was followed by a single bloodworm, while the green arm served as the S-. For the other 6 fish, the blue stimulus served as the S- and the green stimulus served as the S+. The right or left position of each S+ was randomly determined at the beginning of each trial. Subjects completed 3 trials per day until choice stabilization was evident, in which the same stimulus (S+ or S-) was selected in 8 out of 10 trials. Overall, 6 of the 12 subjects preferred the S+ over the S- while 2 fish failed to stabilize on a single reward; trials with the other four fish are nearing completion with most of them trending towards preference for the S+. Replicate trials are currently being conducted using another squad of naive subjects. The preference for signaled reward indicates that *Danio rerio* can be used for instrumental choice research, and future studies should use an inbred strain of *Danio rerio* to reduce genetic variability that may contribute to individual differences in the acquisition of instrumental responding.

Statistics

SUPPORT VECTOR MACHINES WITH THE RAMP LOSS AND THE HARD MARGIN LOSS. J.P. Brooks, Dept. of Stat. Sci. and O.R., Virginia Commonwealth University, Richmond, VA 23284. The support vector machine (SVM) is a well-established method for classification based on an approach that emphasizes minimizing misclassification error while maximizing the distance between sets of correctly

classified observations. In training models, SVM uses a measure of error that is based on the Euclidean distance of observations from the separating surface. In the interest of increasing the robustness of SVM, we present two new integer programming formulations that incorporate the ramp loss and the hard margin loss, respectively. These formulations are able to accommodate nonlinear kernel functions that have made traditional SVM popular. The consistency of SVM with these loss functions is established. Analysis of simulated and real-world data sets indicates that Ramp Loss SVM is preferred over both Hard Margin Loss SVM and the traditional Hinge Loss SVM in the presence of outliers when a low-rank kernel function is employed.

EVALUATING STATISTICAL SIGNIFICANCE IN SUPERSATURATED DESIGNS. David J. Edwards, Dept. of Statistical Sciences and Operations Research, Virginia Commonwealth University, Richmond, VA 23284 & Robert W. Mee, Dept. of Statistics, Operations, and Management Science, Univ. of Tennessee, Knoxville, TN 37996. Two-level supersaturated designs (SSDs) are designs that examine more than n-1 factors in n runs. Although literature involving the construction of SSDs is plentiful, less has been written about analysis of data from these designs. Perhaps this is due in large part to the dearth of actual applications. Whether using forward selection or all-subsets regression, it is easy to select models from SSDs that explain a very large percentage of the total variation. Hence, naïve p-values can persuade the user that included factors are indeed active. We propose the use of a global model randomization test in conjunction with all-subsets to more appropriately select candidate models of interest. For settings where the number of factors is too large for repeated use of all-subsets to be applied repeatedly, we propose a short-cut approximation for the p-values based on the beta distribution. Finally, we propose a randomization test for reducing the number of terms in candidate models with small global p-values.

USING SIMULATION OPTIMIZATION TO CONSTRUCT EFFICIENT SCREENING STRATEGIES FOR CERVICAL CANCER. Laura A. McLay & Chris Foufoulides, Dept. of Stats. & Oper. Res., Virginia Commonwealth Univ. Cervical cancer is the second most common type of cancer in women worldwide. Because cervical cancer is usually asymptomatic until the disease is in its advanced stages, cervical screening is of central importance towards combating cervical cancer. Alternative screening strategies are evaluated from an economic point of view through cost-effectiveness analysis. In the literature, however, studies perform cost-effectiveness analysis on a limited number of de facto screening policies. At present, no attempt has been made to construct efficient screening strategies through optimization, before cost-effectiveness analysis is applied. In this study simulation optimization is used to construct efficient screening strategies for cervical cancer by properly timing the screenings. The constructed strategies are highly cost-effective when a small number of lifetime screenings is available, and are more cost-effective than screening strategies used in practice or considered in the literature so far, indicating the value of optimal timing for other screened diseases as well.

EVALUATING THE ASYMPTOTIC LIMITS OF THE DELETE-A-GROUP JACKKNIFE FOR MODEL ANALYSES. Phillip S. Kott, National Agricultural Statistics Service, Department of Agriculture, Fairfax VA 22030 & Steven T. Garren, Department of Mathematics and Statistics, James Madison University, Harrisonburg VA 22807. The delete-a-group jackknife can be e ectively used when estimating the variances of statistics based on a large sample. The theory supporting its use is asymptotic, however. Consequently, analysts have questioned its e ectiveness when estimating parameters for a small domain computed using only a fraction of the large sample at hand. We investigate this issue empirically by focusing on heavily poststrati ed estimators for a population mean and a simple regression coe cient, where the poststrati cation take place at the full-sample level. Samples are chosen using di erentially-weighted Poisson sampling. The bias and stability of delete-a-group jackknife employing either 15 of 30 replicates are evaluated and compared with the behavior of linearization variance estimators.

INFORMATION REDUCTION FOR BIAS AND VARIANCE ESTIMATION. Leonard A. Stefanski, Dept. of Stat., N.C. State Univ., Raleigh, NC 27696-8203. The jackknife and bootstrap are two well-known methods of reducing bias and estimating variance. Simulation-extrapolation is a method of reducing bias and estimating variance in measurement error models that works by adding more error to the observed data. Omitting an observation (jackknife), sampling from the observed data (bootstrap), and adding noise to data (simulation-extrapolation) are all ways of reducing information in a data set. In this talk I show that all three methods are conceptually similar when viewed in terms of information reduction, and argue that doing so is sometimes advantageous.

Structural Biology, Biochemistry and Biophysics

NEUROSTEROID REGULATION OF IONOTROPIC GLUTAMATE RECEPTORS. Sarah Rhoads & Lisa Gentile, University of Richmond. AMPA, NMDA and kainate receptors belong to the ionotropic glutamate receptor (iGluR) family. As binding to glutamate, a major fast excitatory neurotransmitter, causes activation of these channels, they play an important role in synaptic plasticity, memory and learning. Our research focuses on understanding how these receptors are regulated binding for potential applications in conditions such as Alzheimer's and Parkinson's disease. The data presented here is aimed at understanding the differential regulation of NMDA receptors by the endogenous neurosteroids pregnenolone sulfate (PS) and 3α-hydroxy-5β-pregnan-20-one sulfate (PREGAS). PS potentiates the activity of NMDA receptors containing an NR2B subunit while it inhibits those containing an NR2D subunit. PREGAS negatively regulates all iGluRs. Intrinsic and extrinsic fluorescence studies will be presented that confirm the binding of the NMDA NR2B S1S2 and amino terminal domain (ATD) to both PS and PREGAS. Unlike the NR2B subunit, the NR2D S1S2 domain does not bind to PS and PREGAS, however the NR2D ATD does bind to both neurosteroids. Data from isothermal titration calorimetry and Stern-Volmer

analysis will be presented to help differentiate the binding site of each of these neurosteroids on both the NMDA NR2B and NR2D subunits.

CHARACTERIZATION OF RECOMBINANT ASPERGILLUS FUMIGATUS SIDA: A FLAVIN-DEPENDENT N-HYDROXYLASE WITH BOUND FLAVIN COFACTOR. Samuel W. Chocklett & Pablo Sobrado Department of Biochemistry, Virginia Tech, Blacksburg, VA 24060. *Aspergullus fumigatus* (*Af)* SidA, is the flavin-dependent enzyme that catalysis the NADPH-dependent hydroxylation of L-ornithine in ferrichrome biosynthesis. *Af* SidA was recombinantly expressed and purified as a soluble tetramer with a bound FAD cofactor. *Af* SidA is the first member of this class of flavin monooxygenases to be isolated with a tightly bound flavin cofactor. The enzyme showed typical saturation kinetics with respect to L-ornithine, while substrate inhibition was observed at high concentrations of reduced coenzyme. Increasing concentrations of hydrogen peroxide were measured as a function of coenzyme concentration, indicating that inhibition was caused by an increase in uncoupling. *Af* SidA is highly specific for its amino acid substrate, only hydroxylating L-ornithine. In contrast, an 8-fold preference in the catalytic efficiency was determined for NADPH as compared to NADH. In the absence of substrate, *Af* SidA can be reduced by NADPH and a stable C4a-(hydro)peroxyflavin intermediate is observed. The decay of this intermediate is accelerated by L-ornithine binding, and was only stabilized by NADPH and not by NADH, suggesting a role for $NADP^+$ in the stabilization of intermediates in the reaction of *Af* SidA. $NADP^+$ is a competitive inhibitor with respect to NADPH, demonstrating that *Af* SidA forms a ternary complex with $NADP^+$ and L-ornithine for catalysis. These data indicates that *Af* SidA likely proceeds by a sequential kinetic mechanism. Supported in part by the Allan T. Gwathmey Chemistry award from the Virginia Academy of Sciences and Ralph Powe award from ORAU.

ADVANCING THERAPEUTICS FOR ALZHEIMER'S DISEASE WITH MOLECULAR DYNAMICS SIMULATIONS. Justin A. Lemkul & David R. Bevan, Department of Biochemistry, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. Neuronal deposition of the amyloid β-peptide (Aβ) is believed to trigger the symptoms of Alzheimer's disease, the leading cause of senile dementia that afflicts over 5 million Americans. *In vitro* and *in vivo* studies suggest that natural products, such as flavonoids, may be effective in preventing and reversing this protein aggregation, but their mechanism of action is unknown. We conducted molecular dynamics (MD) simulations on a model of the Aβ protofibril in the presence of the flavonoid morin to understand how this compound, one of the most potent anti-aggregation flavonoids, may function in destabilizing pre-formed Aβ aggregates. Our results indicate that morin principally binds to the end of the protofibril, occupying backbone hydrogen bonds that are exposed to solvent and would otherwise be accessible to an incoming peptide. We call this binding mode a "capping network," and we have demonstrated that this configuration effectively blocks the attachment of an incoming peptide. Morin can also penetrate into the hydrophobic core of the protofibril structure, where it associates with the Asp23-Lys28 salt bridges and interferes with backbone hydrogen bonding to destabilize the native structure. The material is based

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