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ABSTRACTS OF PAPERS, 87th Annual Meeting of the Virginia Academy of Science, May 27-29, 2009, Virginia Commonwealth University, Richmond VA

Aeronautical and Aerospace Sciences

FROM THE EARTH TO SPACE WITH NACA/NASA. M. Leroy Spearman. NASA-Langley Research Center, Hampton, VA 23681 & Heidi Owens, Auburn University, Auburn, AL 36849. 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 December 17, 1903 that the Wright Brothers, at Kitty Hawk, NC, were credited with achieving the first manned-powered flight. Over the next 100 years, several factors have influenced advances in aviation. The use of aircraft by European nations in World War I resulted in concern that the U.S. was lagging in aviation developments. This lead to an act of the U.S. Congress in 1915 that established the National Advisory Committee for Aeronautics (NACA) with the charge to conduct aerodynamic research. The research began at Langley Field, VA in the early 1920's. Over the years this research has transformed low-speed, wood and fabric, propeller-driven airplanes into high speed, all-metal, jet-propelled airplanes. Jet and rocket propulsion enhanced the fields of supersonic and hypersonic aerodynamic flight and provided for access to space. In July 1955 the White House announced plans to launch an earth-orbiting satellite. Before this was done, however, the Soviet Union successfully launched Sputnik, the world's first artificial satellite in October 1957. This event caused concern that the U.S was lagging in the 'space race' and lead directly 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 now contribute to the development of spacecraft as well. Continued advances in aerospace research require 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 many years and the second author of this paper has been a student in the program. Encouragement for researchers is also provided by the VAS and the VJAS.

SIGNIFICANT AERODYNAMIC RESEARCH AT NACA/NASA DURING THE FIRST CENTURY OF FLIGHT. M. Leroy Spearman .NASA- Langley Research Center Hampton, VA, 23681 & Heidi Owens, Auburn University, Auburn, AL 36849.The Wright Brothers are credited with having flown the first manned, heavier-than-air, powered aircraft in December 1903 but the U.S. was slow in accepting the newly introduced airplane. In England, Geoffrey deHavilland produced his first aircraft in1908. In France, Louis Bleriot produced an aircraft in1908. Pre-World War I activities in Europe created concern that the U.S. was lagging behind in the development of aircraft. This concern lead to the creation in the U.S. in 1915 of the National Advisory Committee for Aeronautics (NACA) - a government-funded

research organization that was charged, "to supervise and direct the scientific study of the problems of flight with a view toward their practical solution.". Research began at the NACA in the early1920's and has lead to the advancement from low-speed subsonic flight to high-speed transonic, supersonic, and hypersonic flight and to the possibility of achieving space flight. The possibilities of space flight lead to the creation of the National Aeronautics and Space Administration (NASA) in 1958. The NASA absorbed the existing NACA and the charge for aeronautical research was expanded to include space research. Many aerodynamic problems have been analyzed and corrected through wind tunnel testing. In addition to the wind tunnel research, significant aerodynamic results have been provided with rocket-launched pilot-less aircraft as well as the X series of manned aircraft The research conducted by the NACA / NASA has had a direct impact on the design of aircraft and spacecraft for both civil and military systems.

SOME THOUGHTS ON THE HISTORY OF FLIGHT. M. Leroy Spearman, NASA-Langley Research Center, Hampton, VA 23681 & Robert W. Heath , RRMC, Newport News, 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 December 17, 1903 that the Wright Brothers, at Kitty Hawk, NC, were credited with achieving the first manned-powered flight. Over the next 100 years, several factors have influenced advances in aviation. The use of aircraft by European nations in World War I resulted in concern that the U.S. was lagging in aviation developments. This lead to an act of the U.S. Congress in 1915 that established the National Advisory Committee for Aeronautics (NACA) with the charge to conduct aerodynamic research. The research began at Langley Field, VA in the early 1920's. Over the years this research has transformed low-speed, wood and fabric, propeller-driven airplanes into high speed, all-metal, jet-propelled airplanes. Jet and rocket propulsion enhanced the fields of supersonic and hypersonic aerodynamic flight and provided for access to space. In July 1955 the White House announced plans to launch an earth-orbiting satellite. Before this was done, however, the Soviet Union successfully launched Sputnik, the world's first artificial satellite in October 1957. This event caused concern that the U.S was lagging in the 'space race' and lead directly 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 now contribute to the development of spacecraft as well.

AN AIRCRAFT DESIGN CONCEPT APPLICABLE FOR VARIOUS MISSION REQUIREMENTS M. Leroy Spearman, NASA-Langley Research Center, Hampton, VA and Katie Klein, MITRE Corp., McLean,VA. Airlift capability can be useful as a means of providing the logistic support of manpower, supplies and equipment in the event of natural disasters such as floods and hurricanes. The need for such support could be within the homeland area or might be at distant worldwide locations. Often, the location for such support may be inaccessible by normal means of transportation. Conventional aircraft can provide the need for speed but the load capacity may be

limited and the requirement for a suitable landing area is critical. An effort to combine the requirements for capacity, speed and basing, has lead to some studies of unconventional aircraft designs. One design concept that has been considered utilizes a large rectangular wing surface with large bodies attached to each wing tip. The use of the two large bodies results in essentially doubling the capacity of a conventional single-body aircraft with no increase in length. The large area of the wing provides adequate lift to sustain normal flight with heavy loads. The bodies could also be shaped to provide for water-based operation With the wing positioned high on the bodies a cushion of air would be provided that would permit operation as a wing-in-ground (WIG) effect vehicle. With judicious positioning of trailing-edge wing flaps and vectoring jet nozzles, vertical take-off and landing (VTOL) capability could be achieved. In addition, the bodies could be designed to contain some helium for buoyant lift with additional kinetic lift provided by the wing. Thus, the inboard wing, twin-body arrangement potentially provides for large load carrying capability with a vehicle that could operate in free-air as an airplane, or near the surface in a WIG mode. Such a design would also have greater basing freedom in a VTOL mode or as a hybrid airship.

Agriculture, Forestry and Aquaculture Science

THE EFFECTS OF SHEEP ON NITROGEN CONCENTRATIONS IN SOIL. Sarah J, Casey, Dept. of Biol., Ferrum College, Ferrum, VA 24088 & Brian D. Whitaker, Dept. of Agriculture, Ferrum College, Ferrum, VA 24088. Ruminants are an important part of agriculture because they add value to the existing ecosystem. This study was conducted to evaluate the effects of grazing sheep on agroforestry pasture on the nitrogen content of the soil. Sheep were placed on a traditional grazing pasture or an agroforestry pasture (with trees). Soil samples were collected at 0, 30, and 60 d during the study and analyzed for total nitrogen content at the end of the study. The amount of nitrogen in the soil from the forest without sheep was significantly greater ($P < 0.05$) compared to the other plots. These results indicate that producing sheep on agroforestry based pasture may increase the quality of the soil by increasing the nitrogen content over time.

NODULATION TRAITS OF TEPARY BEAN INOCULATED WITH 15 BRADYRHIZOBIAL STRAINS. Michele Mohrmann & Harbans L. Bhardwaj, Agricultural Research Station, PO Box 9061, Virginia State University, Petersburg VA 23806. In order to develop tepary bean (*Phaseolus acutifolius* A. Gray), a highly drought-tolerant summer crop, as a summer legume cover crop to meet N needs of succeeding winter cereals, we studied nodulation following seed treatment of three tepary bean lines (Black, Tan, and White-seeded) with 15 bradyrhizobial strains. In this replicated greenhouse study, we nodule number, and nodule size from approximately 40-day old plants. Nodule numbers were recorded on a scale of 1 (less than five nodules per plant) to 3 (greater than 20 nodules per plant) whereas nodule size was recorded on a scale of 1 (nodules small and similar to mustard/canola seed in size) to 3 (nodules large and similar to soybean seed in size). We also recorded chlorophyll readings with Minolta SPAD-502 meter. Significant differences were observed among

15 bradyrhizobial strains for all traits under study. Differences among three tepary bean lines were not significant. Results indicated that UMR-3007, UMR-3043, and USDA-3254 strains were the most efficient nodulators of tepary bean. Significant and positive correlations exited between SPAD readings and nodule number score (0.70**) and nodule size score (0.43**).

THE ANORECTIC EFFECT OF NEUROPEPTIDE AF IS ASSOCIATED WITH SATIETY-RELATED HYPOTHALAMIC NUCLEI. B.A. Newmyer, M.A. Cline & M. Smith, Radford University, Department of Biology, Radford VA 24142. Neuropeptide AF (NPAF), a member of the RFamide family, is encoded by the same gene as neuropeptide FF (NPFF) which causes short-term anorexia. However, reports on the role of NPAF on appetite-related process are lacking. Thus, intracerebroventricular (i.c.v.) injections of 4.0, 8.0 and 16.0 nmol NPAF were administered to chicks in order to observe its effect on food and water intake. Chicks treated with 8.0 and 16.0 nmol i.c.v. NPAF decreased both their food and water intake. Additionally, all doses of NPAF injected caused a similar reduction in whole blood glucose concentration 180 min after injection. In a second experiment, chicks that received i.c.v. NPAF had increased number of c-Fos immunoreactive cells in the dorsomedial, paraventricular (magnocellular and parvicellular parts) and ventromedial nuclei. The arcuate nucleus and lateral hypothalamic area were not affected. In a third experiment, NPAF-treated chicks exhibited fewer feeding pecks and spent less time perching, while increasing time spent in deep rest. Other behaviours including exploratory pecking, escape attempts, defecations, distance moved, and time spent standing, sitting and preening were not affected by NPAF injection. We conclude that NPAF causes anorectic effects that are associated with the hypothalamus.

CALCITONIN GENE-RELATED PEPTIDE IS ASSOCIATED WITH ANOREXIGENIC EFFECTS IN CHICKS (*Gallus gallus*). Wendy A. Calchary & Mark A. Cline, Department of Biology, Radford University, Radford VA 24142. Calcitonin gene-related peptide (CGRP) is released from the gastrointestinal tract following ingestion and causes satiety in mammals. Its effects on appetite in non-mammalian vertebrates are unreported. In Experiment 1, fasted chicks reduced food and water intake after central injection of CGRP. In Experiment 2, central CGRP caused increased c-Fos immunoreactivity in the arcuate (ARC) nucleus, paraventricular nucleus (PVN), periventricular (PHN) and ventromedial (VMH) hypothalamic nuclei. The results of Experiment 3 demonstrate that intraperitoneal injection of CGRP also causes reduced food and water intake. c-Fos immunoreactivity was increased in the ARC, PHN, PVN and VMH in Experiment 4 after intraperitoneal injection of CGRP. In chicks and mammals stimulation of opioid receptors stimulates feeding. Interestingly, increased CGRP concentration coincides with decrease morphine function in the rodent central nervous system. In Experiment 5, co-injection of CGRP and beta-funaltrexamine did not suppress food intake more than CGRP and beta-funaltrexamine when injected alone. In Experiment 6 co-injection of CGRP and ICI-174,864 caused a greater reduction in food intake than CGRP and ICI-174,864 when injected alone. In Experiment 7, co-injection of CGRP and nor-binaltorphimine caused a greater reduction in food intake than CGRP and nor-binaltorphimine when injected

alone. In Experiment 8, CGRP did not reverse hyperphagia induced by NPY. In Experiment 9, hyperphagia induced by B-endorphin was reversed by CGRP. In conclusion, the mechanisms of CGRP induced satiety have some similarities and differences between avian and rodent models. The results presented here provide new insight into the evolution of vertebrate satiety regulatory mechanisms.

BIOLOGICAL NITROGEN FIXATION IN WHITE LUPIN. Harbans L. Bhardwaj, Agricultural Research Station, PO Box 9061, Virginia State University, Petersburg VA 23806. White lupin (*Lupinus albus* L.), one of five cultivated species of *Lupinus* genus, has tremendous potential as a grain and a green manuring crop. During 1940s, it was used to supply N to succeeding cotton crop in the southern USA sometimes called "The Lupin Belt". Availability of cheap fertilizers, lack of cold-tolerance, and agricultural policies resulted in lupin's demise so that by 1960s it has almost disappeared. Recently, there has been a renewed interest in using lupin as legume cover crop to meet N needs of succeeding crops. Lupin seed and plant tissue are characterized by low alkaloids ("Sweet") or high alkaloid ("Bitter"). It is desirable to have lupin lines with sweet seeds and bitter plant tissue since bitter plant tissue can act as a natural pesticide for disease and insect pests upon incorporation into the soil. We conducted biological N Fixation (BNF) studies with lupin lines varying in their alkaloid contents. The results indicated that high-alkaloid (Bitter) lupin lines had greater nodulation, a measure of biological N fixation, as compared with low-alkaloid (Sweet) lines. However, enough variation existed among the 97 germplasm lines to indicate that it may be possible to develop lupin lines with sweet seed and bitter plant tissue.

POST-HARVEST EXTENSION OF MARKET SEASON FOR POND-RAISED LIVE FRESHWATER SHRIMP IN GREENHOUSE TANKS. Brian L. Nerrie, Virginia Cooperative Extension, PO Box 9081, Virginia State University, Petersburg VA 23806. Freshwater shrimp (*Macrobrachium rosenbergii*) are fast-growing tropical organisms that are increasingly farmed in Virginia, especially in the tobacco growing counties. They are stocked as juveniles (~0.2 g) in late May-early June and harvested in late September-early October (>35 g). More than 80% of the freshwater shrimp harvested in Virginia are sold fresh on-ice to buyers on harvest day ($16.00-25.00/kg) with some frozen for future sales. *M. rosenbergii* cannot survive water temperatures below 14ºC. A demand exists for off-season live fresh shrimp. Shrimp harvested from ponds at VSU's Randolph Farm during the first week of October 2007 were either frozen (-10 ºC) or transferred to aerated 1000 liter circular tanks. Tanks were equipped with substrate (orange-plastic fencing) and stocked at a low density of 25 shrimp per tank. Water temperature was maintained between 15-20 ºC by aquaria heaters to reduce the need for feeding, and therefore minimize growth, molting and cannibalism. Shrimp were harvested after 150 days on 20 March and a taste test conducted to compare with previously frozen whole shrimp. A taste panel reported high acceptance and no differences (P>0.05) in taste, texture, and appearance between the previously frozen shrimp and fresh inventoried shrimp. Shrimp mortalities (>50%) were observed associated with high tank water temperature resulting from outside temperatures exceeding 30ºC.

SURVIVAL AND GROWTH COMPARISONS OF CATFISH (*ICTALURUS PUNCTATUS*) FINGERLINGS IN CAGES OVER WINTER, SECOND-YEAR TRIAL WITH INDUSTRY APPLICATION. Scott H. Newton & Edward N. Sismour, Agriculture Research Station, PO Box 9061, Virginia State University, Petersburg VA 23806. Channel catfish (*Ictalurus punctatus*), an important fishery resource in Virginia, are regularly imported from southern states because of high demand. Previous results suggested that purchasing fingerlings in the fall and holding them over winter might be an effective management strategy to increase productivity and reduce mortality associated with transport and stocking in the spring. We conducted a second-year trial from November 2008 to April 2009 at VSU and at Gold Hill farm (GHF) in Buckingham County. Two groups of catfish purchased in 2008, one in April (spring) and the other in mid-October (fall), were compared. Fingerlings were restocked in mid-November at both locations into separate sets of three cages with 250 fish per cage. Total lengths and weights were measured on subsamples of 60 fish per cage at both stocking and harvest. Fish were fed a standard, floating-pellet ration when winter pond water temperature exceeded 10 °C. Catfish fingerlings in 2007-08 increased in weight by 17% for the spring group and 25% for the fall group, and both groups had high (>99%) survival. No increase in length or weight was observed in 2008-09 and survival was much lower, about 60% at both VSU and GHF for the spring catfish and about 30% and 70%, respectively, at VSU and GHF for the fall catfish. Fingerlings at VSU were affected by an out break of White Spot disease (Ich). Persistent, low (<10 °C) water temperature over the 2008-09 winter limited feeding opportunities resulting in poor growth and survival performance.

SURVIVAL AND GROWTH OF CHANNEL CATFISH (*Ictalurus punctatus*) FINGERLINGS IN CAGES WITH LONG-TERM ORAL ADMINISTRATION OF B-GLUCAN, AN INITIAL ASSESSMENT. Edward N. Sismour & Scott H. Newton, Agriculture Research Station, PO Box 9061, Virginia State University, Petersburg VA 23806. Bacterial disease is a major cause of financial loss to aquaculture producers. Antibiotics are typically used to control disease; however, only a small number are approved for food fish and legal restrictions limit usage. Immune system enhancement is an alternative approach with demonstrated benefits in numerous agricultural applications. β-1,3/1,6-Glucans are an integral part of the cell wall in bacteria, fungi, and some plants. The structural pattern is highly conserved and binding of these molecules to pattern recognition receptors in macrophage cell membranes upregulates nonspecific immune responses of these cells. Unlike antibiotics, β-1,3/1,6-glucan preparations are commercially available without restrictions on their application. The purpose of the present study was to evaluate the effect of β-1,3/1,6-glucan administered orally in the feed on the growth and survival of channel catfish fingerlings grown in cages. The glucan preparation used for this study was Agrastim®, and the basal ration was standard, commercially available, floating-pellet aquaculture feed. Two trials were conducted. In the first, 50 mg/kg and 100 mg/kg glucan dosages were compared to the basal ration and to the basal ration plus 1.2% agar top-coat used to facilitate application of glucan to the feed pellets. Treatments were isolated in separate ponds to prevent cross-contamination. The second trial compared the basal ration and 100 mg/kg glucan treatments in the same pond. At the dosages evaluated for this study, catfish survival

and growth were not improved over control treatments; however, beneficial effects of glucans have been reported at higher dosages and additional research is suggested.

DISEASES OF CAGE-REARED CATFISH. David Crosby[1], Edward N. Sismour[2] & Scott H. Newton[2], [1]Virginia Cooperative Extension, Virginia State University, PO Box 9081, Petersburg VA 23806 and [2]Agriculture Research Station, PO Box 9061, Virginia State University, Petersburg VA 23806. Many producers of catfish in Virginia use farm ponds that are only suited for cage production. Catfish fingerlings are purchased from out-of-state producers and can spend over 20 hours in transit on a hauling truck. Transport time, crowding and associated factors may cause stress that potentially induces disease outbreaks. A study, initiated in 2007, is underway to assess and quantify factors contributing to catfish mortality following transport and cage stocking in the spring and the fall. Fish health assessments are conducted at the initial stocking and at 1, 2, and 3 weeks post stocking for which 60 fish are examined for diseases and external parasites on gills and skin. Not surprisingly, *Henneguya* sp was found at all initial stockings and during post stocking. Proliferative gill disease (PGD) was found at all initial spring stockings. However, fall stocking showed no clinical signs of PGD. Stocked catfish were infested with Ich within two weeks, except during fall 2008 when the catfish came down with Red Sore Disease. *Trichodina* sp and gill worms (*Ligictaluridus* sp.) were found in all spring initial stockings. The two fall stockings were free of most gill and skin parasites except for *Henneguya*. The 2007 spring stocking incurred 50% mortality attributed to Enteric Septicemia and columnaris. The 2007 fall stocking incurred only 1% mortality while the 2008 fall stocking had over 80% mortality. Fish stocked in the spring had more potential problems such as *Trichodina*, PGD and gill worms while fall fish had relatively few or any potential problems.

INSECTICIDAL ACTIVITIES OF *PARTHENUM ARGENTATUM* GRAY CRUDE METHANOLIC EXTRACT AND EXTRACT FRACTIONS ON ADULT GREENHOUSE WHITEFLY. F.D. Favi[1], M. Tellez[2], S.O. Duke[2] & M. Kraemer[1], [1]Virginia State University, Agricultural Research Service, PO Box 9061, Petersburg VA and & [2]University of Mississippi, USDA/ARS National Center of the Development of Natural Products, PO Box 8084, Stoneville MS. *P. argentatum* (guayule) is a perennial plant introduced into the US for production of latex for medical use as an alternative to latex from the hevea tree. Guayule latex is used for medical purposes because it does not induce reactions as does hevea's latex. Guayule resin content represents 10% of whole plant-extract and has pest control activities. Methanolic extract and its fractions were used to assess resin toxicity on adult greenhouse whitefly. Ethyl acetate fractions were coded A-C, methanolic fractions coded D-H and N-P while methylene chloride fractions were named I-M. Extracts were either used to coat vials or applied to tomato leaf disk to study contact or oral toxicities respectively. ANOVA (SAS statistic package, 2004) was used to analyze the results. Contact toxicity of fractions (D-H and N-P) were significant with f = 4.78 df = 9, P < 0.001. However, fractions coded H and P had killed adult whiteflies by contact within 3 hours and had been selected as the most toxic fractions of guayule methanol extract. Fractions J and L have significantly good oral toxicity at a very low dose (f = 71.32, df = 4, p < 0.0001).

ANAGEMENT OF A NATIVE BEE FOR POLLINATION OF VIRGINIA APPLE ORCHARDS. <u>Mark E. Kraemer</u>, Chelsea Johnson & Françoise Favi, Agricultural Research Station, Virginia State University, Petersburg VA 23806. The blue orchard bee (*Osmia lignaria* Say) is native to most of temperate North America and known to be an excellent pollinator of apple and other rosaceous tree fruits. However, management techniques need to be developed before this bee can be used in orchards. Initial research identified natural enemies and the life cycle phenology of this bee in Virginia. In the last two springs these bees were tested in 3 apple orchards in Virginia and North Carolina using artificial nesting sites. Adult bees established nests in sheltered areas near the orchards and were able to increase their numbers by up to 3X in one season. Parasitism was not a significant problem although pollen mites were present and could be a secondary problem if larval mortality is significant and large amounts of pollen are left for pollen mites. Pesticide sprays did not appear to affect nest building activity but larval mortality was high (20%) in one orchard and may have been correlated with early season fungicide applications. Large amounts of apple pollen, up to 98%, were found in some nest cells constructed during apple bloom.

ANALYSIS OF ESTS FOR DIFFERENTIAL GENE EXPRESSION TO ANTHRACNOSE IN YAM (*Diascorea alata* L). Satya S. Narina[1], Brian L. Sayre[1], Shaukat M Siddiqi[1], Alieu Sartie[2] & Robert Asiedu[2], [1]Department of Biology, PO Box 9064, Virginia State University, Petersburg VA 23806 and [2]International Institute of Tropical Agriculture (IITA), Oyo Road, PMB 5320 Ibadan, Nigeria. Molecular markers are ideal to investigate genetic effects on the resistance/susceptibility to disease. Simple Sequence Repeats (SSRs), repetitions of nucleotide motifs of 1-5 bases, are currently the markers of choice due to their abundant distribution in the genomes, and suitability for high-throughput analysis. Yam, (*Dioscorea alata* L), the main food source for over 100 million people in humid and sub-humid tropics, is vulnerable to anthracnose (*Colletotrichum gloeosporioides*) disease. This is one of the major limiting factors in the production of yam worldwide. A collaborative project between the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, Africa and Virginia State University, Petersburg, Virginia, USA was developed for genetic improvement and germplasm characterization of yams using molecular tools. Very limited sequence information is available from public genome databases. Total RNA was isolated from young leaves of resistant and susceptible genotypes and cDNA libraries corresponding to these two lines were constructed using Clontech's Creator SMART cDNA library construction kit. The libraries from the resistant and susceptible genotypes now have a total of 85,000 and 80,000 cDNA clones, respectively. These cDNA clones are currently being sequenced and nearly 80,000 EST sequences generated from this project are presented.

Astronomy, Mathematics and Physics

QUANTITATIVE ANALYSIS OF BACKGROUND RADIATION PARTICLE TRACKS IN A LARGE DIFFUSION CLOUD CHAMBER USING "IMAGEJ" DIGITAL IMAGING TECHNIQUES. Robert Brik[1] & David B. Hagan[2], [1]Massachusetts Institute of Technology 02139 and [2]Science Museum of VA, 2500 W. Broad St., Richmond VA 23220. Cloud chambers are used to view radiation trails from solar, cosmic, and terrestrial sources. Image processing software was utilized to identify and quantify the differences between various particles. Alpha, Beta, Proton, and Muon particle images were analyzed to determine every particle's general geometry. Images were collected from the manufacturer, from photography, and from video. Each image was thresholded and then a statistical analysis was run. The particles' were found to have certain characteristics that made them distinct and easily identifiable by imaging software. Some of the more distinguishing traits were shown to be the ratio of area to perimeter, Feret's diameter, intensity skew, kurtosis, and circularity. Additionally, it was shown that a particle may produce various streaks, such as an almost circular point and a long straight line. These variations initially look like different particles; therefore, these similarities and variations have been catalogued as different types of the same particle. Using image analysis to isolate and count the particles allows for more efficient experimentation and a decrease in experimentation error.

SOLVING MATH WORD PROBLEMS WITH ENGLISH GRAMMAR. Richard A. Garrett & Richard S. Groover, Dept. of Math & Science, J. Sargeant Reynolds C.C., Richmond, VA 23228. A short term study in overall student effectiveness solving mathematical word problems took place during Spring 2009 academic semester. Developmental math students, who are prone to higher levels of math anxiety, were essentially learning new problem solving methods despite the fact that their course work was largely review. Students included were studying Algebra and were given a method for solving word problems in their classroom. The method involves breaking sentences down and analyzing their component pieces which are marked by grammar symbols. By properly analyzing these key points in every English sentence within the original problem, students were able to use their own knowledge of the language in order to create a reference map in order to translate English into Mathematics. A complete math problem is then constructed and solved by combining each piece. Encouragement in practicing this method resulted in overwhelmingly positive success rates regarding final answers and pattern recognition. Additionally, students who practiced this method showed higher confidence levels in Mathematics and became more self-motivated in solving problems.

INFRARED EMISSION PROPERTIES OF Nd: KPb_2Br_5 FOR SOLID STATE LASERS. C. Hanley[1], E. Brown[1], U. Hömmerich[1] & S. Trivedi[2], [1] Department of Physics, Hampton University, Hampton VA 23668 and [2]Brimrose Corporation of America, Baltimore MD 21236. We report on the crystal growth and optical properties of Nd:KPb_2Br_5 crystals for potential applications in mid-infrared (MIR) solid-state lasers. Following optical pumping at 800 nm, Nd:KPb_2Br_5 exhibited a broad MIR

emission centered at ~5.25 µm with a bandwidth of ~730 nm at full width half maximum. For a moderate Nd^{3+} concentration of ~5.5 x 10^{19} cm^{-3}, the mid-IR was

predominantly due to transition $^4I_{11/2} \rightarrow \,^4I_{9/2}$. The peak emission cross-section obtained using the Fuchtbauer-Ladenburg method was ~0.6×10^{-20} cm^2. The MIR emission lifetime was measured to be ~50 ms at room temperature. The radiative lifetime obtained from a Judd-Ofelt analysis was ~47 ms, which indicates a MIR emission quantum efficiency near unity. The obtained spectroscopic results suggest the possibility of a MIR laser operating at ~5.5 µm based on Nd: KPb_2Br_5. However, further improvements in the purification and crystal growth of Nd: KPb_2Br_5 are necessary to obtain laser quality samples. This study was funded in part by the National Science Foundation and Army Research Office.

MASSIVE AND MASSLESS BOSONS WITHOUT A HIGGS POTENTIAL. Joseph D. Rudmin, Integrated Science and Technology Dept., James Madison University, 800 S. Main St., Harrisonburg, VA 22807. In 1967, Steven Weinberg, Sheldon L. Glashow, and Abdus Salam published their "WGS Theory" which describes many observed fermions and bosons, and the symmetries of their interactions, and explains why the weak force which transforms those symmetries has short range while the electromagnetic force has long range. This theory offers a unified description of the weak force and electromagnetism. It received the 1979 Nobel Prize in Physics, partly due to its remarkable success in explaining the masses of many particles, and how they interact. However, the Higgs potential mechanism of WGS Theory predicts the Higgs boson, which has not yet been observed. This paper presents an alternative mechanism based on the effects of fermion polarization, for achieving the same result, and some further paradoxes and problems with both mechanisms.

MICROPROCESSOR ARITHMETIC--EFFICIENT LONG DIVISION AND MULTIPLICATION IN ANY NUMBER BASE WITHOUT A MULTIPLICATION TABLE. Joseph W. Rudmin, Dept. of Physics and Astron., James Madison Univ. 22807. Digital accuracy of standard numeric formats is limited by computer processors and by software. Such limitations in 2009 are presented. Methods of avoiding these limits and alternative arithmetic algorithms are presented, including the Russian Peasant Method, and two methods of long division, one of which is suitable for almost arbitrarily large numbers, and the other a new algorithm for long division which does not use trial divisors, and uses only the mathematical operations of shift, add, and subtract.

YORK RIVER, VA WATER TEMPERATURES AS SURROGATES FOR HISTORICAL WATER TEMPERATURES ELSEWHERE IN CHESAPEAKE BAY, VIRGINIA. Thomas C. Mosca III[1] & W.C. Coles[2], [1]Dept of Mathematics, Rappahannock Community College and [2]Division of Fish and Wildlife – Department of Planning and Natural Resources. Temperature is one of the fundamental physical parameters of a body of water, and the rate and magnitude of marine chemical, physical and biological events are highly dependant upon water temperature. However, there are few long-term water temperature data sets in the Chesapeake Bay to establish

temporal trends. The water data maintained by the Virginia Institute of Marine Science (VIMS) at Gloucester Point, VA on the York River are the only continuous long-term water temperature data available for the Virginia portion of the Chesapeake Bay. The purpose of this paper is to present regression equations to predict water temperatures in eight regions of the Chesapeake Bay (upper and lower Virginia portions of the Bay, upper and lower portions of the James, Rappahannock and York rivers), from the VIMS temperature data. These regressions may be used to correlate temperatures with other documented data, and to fill holes in other data sets. We compared the monthly mean temperatures at VIMS to temperatures gathered on a monthly schedule in eight strata of Chesapeake Bay and the three major tributaries. The relationship between the VIMS pier temperatures and temperatures measured in other parts of Chesapeake Bay is very strong ($R^2 \geq 95\%$), and therefore is a useful surrogate for temperature in ecological studies of other parts of the lower Chesapeake Bay.

CONCENTRATION DEPENDENT STUDIES OF THE LASER-INDUCED INFRARED EMISSION FROM KCl-NaCl TABLETS. O. Oyebola[1], U. Hömmerich[1], E. Brown[1], Clayton S. C. Yang[2], S. B. Trivedi[3], A.C. Samuels[4] & A.P. Snyder[4], [1]Department of Physics, Hampton University, VA 23668, [2]Battelle Eastern Science and Technology Center, Aberdeen, MD 21001, [3]Brimrose Corporation of America, Baltimore, MD 21236, and [4]Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD 21010. Laser Induced Breakdown Spectroscopy (LIBS) has emerged as a widely used analytical technique to determine the elemental composition of chemical substances. Most previous LIBS studies were performed in the ultraviolet to near-infrared (~200-980 nm) spectral region. In this work, results are reported on the extension of conventional LIBS to the mid-infrared (mid-IR) spectral region from 2-5 µm. Pumping with a pulsed Nd: YAG laser (1064 nm), mid-IR LIBS signatures were observed from solid KCl tablets at 2.72 µm, 3.15 µm, 3.77 µm, and 4.05 µm. In agreement with the NIST spectral database, the observed mid-IR emission lines were assigned to atomic transitions between higher lying energy states of neutral potassium (K) atoms. Further IR LIBS studies on KCl focused on the 2.72 µm emission line due to its relatively high intensity. A series of KCl-NaCl tablets with different amounts of potassium were prepared to determine the mid-IR LIBS detection limit of potassium. The preliminary results indicated a LIBS detection limit of 0.5wt% of potassium in the prepared KCl-NaCl samples. This study was funded in part by the Army Research Office.

STOCHASTICITY AND SPONTANEOUS SYMMETRY BREAKING IN THERMALLY INDUCED BENDING VIBRATIONS OF STRUCTURES. Anthony A. Teate, Department of Integrated Science and Technology, James Madison University, 800 S. Main St., Harrisonburg, VA 22807. A model is developed for thermally induced bending vibrations of uniformly heated beams in still air that assumes a non-linear dependence of the ratio of the unsteady to the steady-state component of the heat transfer coefficient on the velocity of the bending vibrations. This model also includes *a stochastic driving term* to account for the effects of thermal fluctuations in the ambient air and the concomitant random impacts on the beam and yields a non-linear, stochastic description of the heated vibrating beam for the

dimensionless displacement $S(t)$ of the form:

$$\frac{d\,S(t)}{dt} = \alpha_1\,S - \alpha_2 S^3 + \tilde{F}(t) \quad \text{where} \quad \tilde{F}(t) \quad \text{is purely random,}$$

stationary, Gaussian, process with zero mean, and represents the effects of the amplitude fluctuations due to the random impacts of the ambient air on the beam and

where the α_i are constants dependent upon the thermal and modal bending moments, damping ratio and the phase difference between the velocity fluctuation and thermal bending moments. We solve the stochastic differential equation by constructing a symmetry breaking, bi-stable *Thermal Potential Energy Function*, a Lyapunov global stability function which permits a general investigation and analysis of the system's stability and the effects of pressure on thermally induced bending vibrations.

ASTRONOMICAL POLARIMETRY AT VIRGINIA MILITARY INSTITUTE. Gregory A. Topasna, Daniela M. Topasna & Gerald B. Popko, Department of Physics and Astronomy, Virginia Military Institute, Lexington, VA 24450. We present current work on the design, construction, and testing of a two-beam optical polarimeter to be used with the 20-inch telescope at the Virginia Military Institute observatory. The basic operation of the device will be discussed as well as results which demonstrate the two-beam method in the laboratory. Issues regarding automation and data handling as well as planned observations will be presented.

Biology

DELAYED TREATMENT WITH SILDENAFIL ATTENUATES ISCHEMIC CARDIOMYOPATHY. V.Q. Chau, F.N. Salloum & R.C. Kukreja. Div. of Cardiology, Virginia Commonwealth Univ., Richmond, VA 23298. We previously showed that chronic inhibition of phosphodiesterase-5 (PDE-5) with sildenafil immediately after permanent occlusion of the left anterior descending coronary artery (LAD) limits myocardial infarction (MI)-induced heart failure (HF) in mice. To mimic more clinical scenarios, we hypothesized that chronic treatment with sildenafil beginning at 3 days post MI would also preserve LV function and reduce HF progression. Adult male ICR mice underwent MI by permanent ligation of the LAD after baseline echocardiography was performed. Three days post MI, a repeat echocardiography was conducted. Mice with LV fractional shortening (FS) less than 25% received sildenafil (21 mg/kg; ip; BID, Group I) or volume-matched saline (Group II) for 25 days. At the completion of 28 days following MI, the mice underwent a repeat echocardiography prior to sacrifice. Group I expressed less LV dilatation than group II, and group I showed better contractility as compared with group II. LV end-diastolic diameter (LVEDD), increased from a baseline value of 3.4 ± 0.1 mm to 4.2 ± 0.1 at 72 hr post MI. At 28 days post MI, LVEDD was increased to 5.2 ± 0.1 mm for group II, as compared 4.6 ± 0.1 mm in group I (P<0.05 vs. Group II). Fractional shortening decreased from a baseline value of $47 \pm 1\%$ to $19 \pm 1\%$ at 72 hr following MI. At 28 days post MI, FS was $21 \pm 1\%$ for group I and $13 \pm 1\%$ for group II, (P<0.05 vs.

Group II). For the first time, these results show that chronic sildenafil treatment initiated at 3 days post MI attenuates ischemic cardiomyopathy by limiting LV dilatation and preserving FS. Sildenafil may be a promising therapeutic tool for prevention of HF in patients with MI.

CONTROLLED ASSEMBLY OF NANOSCALE PROTEIN/DNA "BASKETS" FOR THE *IN VIVO* DELIVERY OF siRNA PARTICLES. A.C. Zirzow, C.B. Smith, and A.V. Baranova, Dept. of Mol. and Microbiol., R. Couch and A.S. Patanarut, Dept. of Chemistry, George Mason Univ., Fairfax VA 22030. The purpose of this research is to develop a novel vector for the *in vivo* delivery of siRNA particles. In attempt to overcome current siRNA transfection problems of cytotoxicity, physical size of vector, instability of siRNA, and rapid clearance from the bloodstream, we developed the concept of a nanoparticle comprised of an outer cage made of protein and DNA (DNA "basket") that is capable of carrying siRNA cargo. This investigation demonstrates that protein/DNA interactions can be exploited to form DNA "baskets" with a stable mean size distribution. Derinat (Деринат), a DNA-based immunomodulator, is employed as the DNA component of these DNA "baskets". When prepared in the absence of protein, Derinat retains a stable mean size distribution of 762.4 ± 7.26 nm. When this DNA is vacuum concentrated with a specific quantity of bovine serum albumin (BSA), the mean size distribution can be significantly reduced by up to 98%. Reduced mean diameters of the DNA/BSA complex may allow for more efficient *in vivo* cellular uptake. The next step in this investigation is to determine if a DNA/BSA complex can contain and hinder the degradation of GFP specific siRNA particles for *in vivo* delivery into GFP mice. The degradation of fluorescently tagged/quenched siRNAs will be monitored *in vitro* in nuclease-containing serum and *in vivo*. This novel approach to siRNA based therapy may minimize side effects, increase cellular uptake, and provide a scaffolding upon which ligands may be attached to direct siRNA to tissues of interest.

A SEARCH FOR *KCNRG* MUTATIONS IN MULTIPLE MYELOMA CELL LINES. Stephanie L. Coon & Aybike Birerdinc & Ancha Baranova. Dept. of Mol. and Microbiol., George Mason Univ., Fairfax VA. 22030. Deletions and or rearrangements on chromosome 13q14.3 are observed in more than half of multiple myeloma (MM) and chronic lymphocytic leukemia (CLL) cases and are also frequently seen in other hematopoietic malignancies. The minimal common deleted region (CDR) in MM cells contains candidate tumor suppressor gene KCNRG (potassium channel regulating gene), the transcript of which suppresses Kv channels associated with the proliferation of lymphocytes. KCNRG exerts growth suppressive and pro-apoptotic effects in HL-60, LnCaP and RPMI-8226 cells.In this study we sequenced KCNRG gene in three multiple myeloma cell lines. We found that RPMI-8226 cell line contains a delT mutation in the core promoter initiator element. Deletion of T decreases matrix similarity of the match from 0.945 to 0.941, and, therefore, might negatively influence expression of KCNRG in RPMI-8226 cells. This suggests that KCNRG expression may be negatively influenced in this model line. The haploinsufficiency of KCNRG might be relevant to the progression of CLL and MM at least in a subset of patients. This research was performed under NIH R1R15CA113331-01, RFFI 07-04-00379-a, 07-04-12232-ofi, and 04-04-08154-ofi.

KPP: KEGG PATHWAY PAINTER. Ganiraju Manyam, Vikas Chandhoke & Ancha Baranova, Department of Molecular and Microbiology George Mason University, Fairfax, VA 22030. High-throughput technologies became common tools to decipher changes of gene expression (GE) patterns. Functional analysis of GE patterns is a daunting task as it often requires recourse to the public repositories of biological knowledge. On the other hand, in many cases researcher's inquiry can be served by a comprehensive glimpse. The KEGG PATHWAY database is a compilation of manually verified maps of biological interactions presented as a set of pathways related to signal transduction and other cellular processes. Rapid mapping of the differentially expressed genes to the KEGG pathways may assist in evaluation of the functional relevance of the results from microarrays and other high-throughput technologies. Web based graphic tool KEGG Pathway Painter (KPP) provides fast and comprehensive visualization of the changes in GE patterns by color-coding pathways from the KEGG database using user defined sets of the candidate genes accompanied by "overexpressed" or "underexpressed" marks, for example, those generated by microarrays. KPP is freely available and can be accessed at http://www.cos.gmu.edu/~gmanyam/kegg/. The study was supported by NIH 1R15CA113331-01 and Service GRA of College of Science, George Mason University.

CUG2 (C6ORF173) IS A NOVEL ONCOGENE INVOLVED IN BREAST CARCINOMA. Elizabeth D. Nohelty[1], M. Skoblov[2], V. Kuznetsov[3], & A. Baranova[1,2], [1]Department of Molecular and Microbiology, George Mason University, Fairfax, VA; [2]Russian Center for Medical Genetics, Moscow, Russia, [3]Bioinformatics Institute, Singapore. The genetic mechanism of the aggression of breast carcinoma has been a topic of research efforts since its discovery in the human population. Previous studies showed that an increase of C6ORF173 expression is associated with shorter survival after breast carcinoma diagnosis (Ivshina et al., 2007). Using Real-Time PCR ready TissueScan Cancer qPCR Arrays comprised of normalized cDNA prepared from pathologist-verified breast carcinoma samples we demonstrated that expression levels of C6ORF173 are significantly (P < 0.013) higher in Grade 3 breast carcinoma tumors as compared to Grade 2. C6ORF173 has been cloned into the pCDNA3.1 expression vector and stably transfected into HCC2157, NM2C5 and MCF-10A breast carcinoma cell lines. Analysis of transfected NM2C5 cells demonstrated a statistically significant increase of proliferation after 48 hrs of incubation with BrDu (P < 0.00016) as well as an increase in migration and invasion, while apoptosis ability of NM2C5 was not changed. Weak homology of C6ORF173 to a known downregulator of transcription (DR1) suggests its involvement in gene expression regulation in a broad sense. If the C6ORF173 gene indeed plays a large role in the aggression of breast carcinoma, it is possible that a genetic screen can be implemented to further improve the predictive diagnostic and treatment of breast carcinoma.

FRANCISELLA NOVICIDA FORMS *IN VITRO* BIOFILMS MEDIATED BY AN ORPHAN RESPONSE REGULATOR. Meghan W. Durham-Colleran, Anne Brooks Verhoeven, & Monique L. van Hoek, Department of Molecular and Microbiology, National Center for Biodefense and Infectious Diseases, George Mason University, Manassas, VA 20110. *Francisella tularensis* is associated with water and waterways,

and infects many species of animals, insects, and protists. The mechanism *Francisella* utilizes to persist in the environment and in tick vectors is currently unknown. We have demonstrated for the first time that *Francisella novicida*, a model organism of *F. tularensis,* forms a biofilm *in vitro*. Selected *F. novicida* transposon mutants were tested for their ability to form biofilm compared to the wildtype *F. novicida* strain. Mutation of the putative *qseB* gene led to an impairment in the ability to form biofilm with no impairment in bacterial growth. A *qseC* mutant had impaired growth, but demonstrated a marked impairment in biofilm production. Mutation in *capC* affected both bacterial growth and biofilm formation, but no biofilm production impairment was seen with *capB* or *pilE* mutants. A deletion mutant in the orphan response regulator FTN_1465, which we propose is the putative QseB, formed significantly less biofilm than the wildtype. When FTN_1465 was complemented back into the deletion mutant, biofilm formation was restored. Thus, the orphan response regulator FTN_1465 is an important factor in biofilm production *in vitro* in *F. novicida*. These results demonstrate that *Francisella* species are able to form biofilms *in vitro*, suggesting that biofilm formation may be important for the life cycle of this organism in the environment or possibly in the tick vector.

TWO MINOR SPECIES AS DOMINANTS IN AN OLDFIELD RODENT COMMUNITY. Robert K. Rose, Dept of Biol. Sci., Old Dominion Univ., Norfolk, Virginia 23529-0266. Oldfields are early stages in secondary succession dominated by herbivores, including three species of common rodents (meadow voles, cotton rats, marsh rice rats). In two oldfield community studies in eastern Virginia, these species comprise >90% of captures, but all were absent in another oldfield habitat, created after logging of a pine forest, clearing, and mechanical planting of pines. There the grasses, sedges, and spikerushes provided habitat to support populations of two minor herbivorous rodents, southern bog lemming (*Synaptomys cooperi*) and woodland vole (*Microtus pinetorum*), which reached densities of 15/ha and 35/ha, respectively, across an 18-month capture-mark-release study. Besides the >450 captures of these two dominants, 7 captures of harvest mice were recorded, but no meadow voles, cotton rats, or marsh rice rats. Some studies conducted elsewhere suggest that southern bog lemmings lose in competition with meadow voles, but the reasons for the presence or absence of a species cannot be determined without experimentation.

BODY SIZE AND GROWTH PATTERNS OF *MICROTUS PENNSYLVANICUS* (ORD.) IN CHESAPEAKE, VIRGINIA. Sara E. Bell & Robert K. Rose, Dept. of Biol., Old Dominion Univ., Norfolk VA 23529-0266. From Dec 2002-Feb 2008, we did a capture-mark-release study on 2 Chesapeake, VA populations of meadow voles (*Microtus pennsylvanicus*). The study sites were effectively 1 ha grids in oldfields. We put 2 modified live Fitch-type traps at 12.5 m intervals and trapped on the grids in monthly 3-day sessions. In northern North America, voles experience autumn and winter weight loss, demonstrate delayed growth and sexual maturation in autumn-born young, have lifespans under 15 weeks, and typically weigh no more than 55 g. Chesapeake voles experienced no seasonal weight loss, exhibited no delayed growth or sexual maturation, lived over 20 weeks, and nearly 20% weighed over 70 g. The longest-lived vole was an 80-week-old male. The heaviest individual voles were over

90 g and present in late autumn and winter at both sites. Breeding occurred year-round. Thus, meadow voles in eastern Virginia contrast sharply with more northerly populations in many aspects of their biology.

NATURAL GENETIC VARIATION IN METABOLIC RATE AND ACTIVITY IN WHITE-FOOTED MICE (*PEROMYSCUS LEUCOPUS)* IN RELATION TO GENETIC VARIATION IN REPRODUCTIVE PHOTORESPONSIVENESS. Madelyn G. Crowell[1], Paul Kaseloo[1], and Paul Heideman[2], [1]Dept. of Biol., Va. State Univ. Petersburg VA 23806 and [2]The Coll. of William and Mary, Williamsburg VA 23185. A naturally-variable life history trait with underlying physiological variation is the photoperiodic response of many temperate zone rodents, including white-footed mice (*Peromyscus leucopus*). Male *P. leucopus* were obtained from a short photoperiod responsive (R) line, selected for reproductive suppression in short-day conditions (SD) and a non-responsive (NR) line selected for reproductive maturity in SD. NR mice consume ~50% more food than R mice, but have no significant difference in body mass. We quantified differences in the energy budgets of these lines through respirometric measurements at thermoneutral temperature. Basal metabolic rate (BMR) was significantly greater in NR than R mice. In addition, NR mice engaged in significantly more daily activity. No significant difference in mass of major metabolic organs or dry mass digestibility of food was found between lines. The increased BMR and sustained metabolic rate in NR mice was correlated with testis size, but not with major central organs. The genetic difference in intake requirements between lines was great enough to be reasonably attributable to selection on the natural genetic variation in BMR and activity in the wild source population. These findings are consistent with differences in thyroid-related hormone activity which recent findings suggest mediate the response to photoperiodic reproduction. This study was funded in part by Howard Hughes Medical Institute.

HABITAT AVAILABILITY AND SPECIES-AREA RELATIONSHIPS OF INDO-PACIFIC SHORE BIOTA. Jonnell C. Sanciangco & Kent E. Carpenter, Department of Biological Sciences, Old Dominion University, Norfolk VA 23529. In marine biogeography, the measure of available habitat is a key factor in identifying the distribution patterns of species richness. The species-area relationship (SAR) has been widely used to infer this correlation of species richness to available habitat. While several studies have shown that larger habitat areas account for a higher number of species, the factors influencing the species richness and the amount of variation have yet to be identified. In this study, the SAR of Indo-Pacific shore biota was tested using the habitat diversity index (H) and coastal length (CL) as functions of area. The H was calculated using the Shannon-Weiner formula with areas of coral reefs, seagrasses, mangroves, and soft bottom as the parameters. Species distribution maps of 6830 marine shore biota (fishes, molluscs, and crustaceans) were created using Geographic Information System (GIS). In addition, multiple GIS tools, extensions and scripts were used to create a 200 meter bathymetry shapefile which was divided into three scale sizes of equal area sections (100, 500, and 1000) to minimize area effect. Values of H, CL, and species richness (S) were identified in each section. Linear regression analyses were performed for S vs H, S vs CL, and S vs H + CL. Results showed significant

differences (<0.001) for all relationships in all scales. H accounts for more variation (14.3-19.3%) than CL (7.6-13.2%), suggesting H as a better predictor of the species richness. Results are portrayed spatially using GIS, where species distribution of marine biota can be easily identified in the map. These results are used to assess the conservation status of marine species and to identify priorities for management.

SEASONAL PHYTOPLANKTON POPULATIONS IN BACK BAY, VIRGINIA Nathan Bowman, Todd Egerton & Harold Marshall, Department of Biology, Old Dominion University Norfolk, Virginia 23529. Back Bay is a flat-bottomed, shallow water ecosystem separated from the Atlantic Ocean by a narrow zone of marshlands, dunes, and residential development. Water depth in the Bay is influenced by the prevailing northeast winds, which may alter the depth in near shore regions by as much as 1.0 m. Presently, the only salt water entry to Back Bay is wind forced, passing into the Bay through a narrow channel from a large sound to the south. Back Bay is classified as a temperate, oligohaline estuary containing salinity ranges from 1.0 - 1.9, and has gained regional interest and concern by state and federal agencies regarding changes to its ecological status. A specific objective of the Back Bay National Wildlife Refuge is to reduce the impact of various environmental factors such as nutrient loading and high turbidity levels that would deteriorate its natural setting. One of the most sensitive components within this habitat to environmental changes is the phytoplankton, which may be used as an ecological indicator of Back Bay's eutrophic status. During the course of one year, the freshwater reaches of the Back Bay oligohaline estuary were sampled bimonthly at a series of six stations comprising the entirety of the bay. The goal of this study is to determine if the specific water quality conditions in this habitat are associated with seasonal changes in the abundance and dominance of specific phytoplankton components, including a changing seasonal flora and phytoplankton categories that occurred between September 2006 and September 2007.

THE BIOLOGICAL ACTIONS OF HYDROXY-CIS-TERPENONES. Tristan A Hayes, Lin Zhang, Qibing Zhou, Ghislaine Mayer & Jennifer Stewart, Virginia Commonwealth University. Hydroxy-cis-terpenone (HCT) was synthesized by Dr. Qibing Zhou in the VCU Chemistry Department. HCT is converted to oxidized HCT (OHCT) in aqueous media. Previous studies demonstrated that micromolar concentrations of HCT and oxidized HCT (OHCT) protect human liver cells from aflatoxin. Additionally, Dr. Ghislaine Mayer in the VCU Biology Department found that nanomolar concentrations of OHCT kill all blood stages of *Plasmodium falciparum*, the parasite responsible for most cases of human malaria. The goal of this project was to investigate mechanisms of HCT actions. Because binding of aflatoxin to microsomal proteins is needed for activation of aflatoxin, we investigated effects of HCT on binding of ^{3}H-labeled aflatoxin to human liver HepG2 cell membranes and human liver microsome proteins. Effects of various concentrations of HCT on protein binding of ^{3}H-labeled aflatoxin were measured at various times from 30 sec to 10 min. The data indicated that HCT at 20 - 40 uM decreased binding of ^{3}H-labeled aflatoxin to proteins within 30 sec. Binding was not ATP-dependent. Low concentrations of HCT (< 10 uM) did not affect binding to cellular proteins. These findings suggest HCT may reduce aflatoxin toxicity by reducing aflatoxin binding to liver cell proteins. This

INVESTIGATION OF DUAL PHENOTYPE GABA/GLUTAMATE NEURONS IN ZEBRAFISH. Lauren P. Bell & Dianne M. Baker, Dept. of Bio. Sci., Univ. Mary Washington, Fredericksburg, VA 22401. The purpose of this research was to investigate the presence of neurons expressing both the inhibitor neurotransmitter, GABA, and the excitatory neurotransmitter, glutamate, in zebrafish. This novel class of neurons has been recently identified in rodents, and increasing evidence suggests they play a role in GnRH signaling. To determine the presence of dual phenotype neurons, we developed *in situ* hybridization (ISH) probes for mRNA encoding proteins involved in GABA synthesis (GAD67) and glutamate transport (VGLUT 2.1 and 2.2). To test theses probes, we performed single-label ISH on whole-mount larva and on adult brain sections. These tests provided consistent evidence that the GAD67 riboprobe is functional in both larval and adult brain tissue. However, the results of ISH using the VGLUT 2.1 and 2.2 riboprobes were inconsistent. Further optimization of ISH conditions is necessary before dual-label ISH can be used to test for presence of dual phenotype GABA/glutamate neurons in zebrafish.

CHARACTERIZATION OF THE EXPRESSION OF CARCINOEMBRYONIC ANTIGEN-RELATED CELL ADHESION MOLECULE 1 IN ZEBRAFISH. Colby S. Croft & Dianne M. Baker, Dept. of Bio. Sci., Univ. Mary Washington, Fredericksburg, VA 22401. The objective of this research was to characterize the spatial and temporal expression of carcinoembryonic antigen-related cell adhesion molecule 1 (CEACAM1) in zebrafish, *Danio rerio*. To assess temporal expression, we first cloned four fragments of the coding region of the zebrafish CEACAM1 gene into *Escherichia coli* so that the CEACAM1 sequence in our strain of zebrafish could be determined. Then, real time primers and probes were designed based on this sequence. Real time PCR was performed on cDNA synthesized from mRNA isolated from embryonic and larval zebrafish at 24, 48, and 72 hours post-fertilization (hpf), and one week post-fertilization. We found a progressive increase in CEACAM1 mRNA expression over a one week period, with levels significantly higher at one week post-fertilization than at 24 hpf ($p<0.05$). To characterize the spatial expression of CEACAM1 in zebrafish, we synthesized sense and antisense DIG-labeled RNA probes for *in situ* hybridization (ISH). The results of the ISH did not reveal a tissue-specific pattern of expression, as both the sense and antisense probes bound nonspecifically in embryos and larvae.

THE CLONING AND CHARACTERIZATION OF A PUTATIVE TYPE VI SECRETED CONSERVED PROTEIN (PA0083) FROM *Pseudomonas aeruginosa*. Nasira M. Rushdan[1], William B. McVaugh[1], Thomas M. Kerkering[2], & Jayasimha Rao[1,2], [1]Biomedical Sciences Department, Jefferson College of Health Sciences, Roanoke, VA 24013, [2]Infectious Diseases, Virginia Tech Carilion School of Medicine, Roanoke, VA 24013. Differentially expressed proteins from *Pseudomonas aeruginosa* have been identified based on a two-dimensional (2-D) gel electrophoresis analysis. The pattern was compared between two genetically similar but phenotypically distinct

P. aeruginosa strains, non-mucoid 383 and mucoid 2192, which were isolated from the same CF patient. In this study, a protein spot was cored based on its elevated expression pattern in the non-muocid 383 strain. The cored spot was subjected to tandem-mass spectrometry, and the identified peptide sequences were classified as PA0083, an unknown hypothetical protein from the PAO1 genome. Bioinformatics analysis predicted that PA0083 has IcmF-associated homologous protein-related loci with a type VI secretion system. PA0083 was cloned into the 6x his-tagged expression system using the Gateway cloning method and recombinant PA0083 protein was produced in *Escherichia coli*. Studies are underway to determine whether PA0083 protein does have a role in pathogenesis.

CLONING AND CHARACTERIZATION OF PUTATIVE SECRETORY HYPOTHETICAL PROTEIN (PA0460) FROM *PSEUDOMONAS AERUGINOSA CLINICAL ISOLATES FROM A CYSTIC FIBROSIS PATIENT*. Joel R. Saul[1], William B. McVaugh[1], Thomas M. Kerkering[2], & Jayasimha Rao[1, 2], [1]Biomedical Sciences Program, Jefferson College of Health Sciences, Roanoke, VA 24013, and [2]Infectious Diseases, Virginia Tech Carilion School of Medicine, Roanoke, VA 24013. *Pseudomonas aeruginosa* is an important pathogen causing chronic lung infections in patients with cystic fibrosis (CF). Differentially expressed proteins in *P. aeruginosa* have been identified based on two-dimensional (2-D) gel electrophoresis analysis. The pattern was compared between two genetically similar but phenotypically distinct *P. aeruginosa* strains, non-mucoid 383 and mucoid 2192, which were isolated from the same CF patient. In this study, a protein spot was selected based on the expression pattern, which was seen only in the mucoid 2192 strain. The cored spot was subjected to tandem-mass spectrometry or mass mapping, and peptide sequences were classified as PA0460, an unknown hypothetical protein from the PAO1 genome. Bioinformatics analysis showed that PA0460 has a putative signal sequence with a cleavage site after 22 amino acids, suggesting that PA0460 could be a secretory protein. PA0460 was cloned into the 6x His-tag expression system using the Gateway cloning method, and recombinant PA0460 protein was produced in *Escherichia coli*.

EFFECTS OF HYPOXIA ON MOUSE CARDIAC MUSCLE MORPHOLOGY. Quincey Garcia[1], Lei Xi[2] & Kathryn E. Loesser-Casey[1], [1] Dept. of Biol., Univ. of Mary Washington, Fredericksburg, VA, 22401 and [2]Dept. of Cardiology, Virginia Commonwealth Univ., Richmond, VA 23298. Systemic hypoxia (SH) can be caused naturally by high altitudes or as a result of a disease process such as sleep apnea or heart failure. Regardless of the initial cause, SH can interfere with a person's oxygen supply resulting in the cells' inability to make ATP by oxidative phosphorylation. However, studies have shown that SH may also have beneficial effects, such as a lower incidence of heart attacks. The exact mechanism of this protection has not been clearly defined and few morphologic studies have been done to study the effect of SH on cardiomyocytes. The goal of this study was to begin characterizing the effect. Three ICR mice were subjected to 2 cycles of systemic hypoxia using a normobaric plexiglass chamber with 10% oxygen. After 4 hours of hypoxia, the animals were allowed to recover for 24 hours and the cycle repeated. The hearts were perfusion fixed, embedded in wax, sectioned and stained. At least 3 sections from each of 3 control

mice and the 3 SH mice were photographed and the areas and diameters of the cells were measured using Image J. The mean diameter of the cardiomyocytes decreased by 16% following SH compared to the control cells. Although there appeared to be a similar decrease in area, a Student's T-test determined that the means of the control and treated groups were not different (p=0.056). Other cells, such as neurons, have been shown to decrease in size after SH but whether the mechanism is similar in cardiomyoctes is unknown.

THE EFFECT OF GLIMEPERIDE AND GLIPIZIDE ON MYOCARDIAL PROTECTION IN STEM CELLS. <u>Jessice R. Themak</u> & Kathryn E. Loesser-Casey, Dept. of Biol., Univ. of Mary Washington, Fredericksburg, VA, 22401 Sulfonylureas are hypoglycemic drugs often used to treat patients suffering from diabetes mellitus. They work by binding to and blocking ATP sensitive potassium channels in β-cells of the pancreas thus regulating the release of insulin. These K^+ ATP channels are also present on the membranes of cardiomyocytes and the opening of these channels can have a cardioprotective effect. However sulfonylureas may ameliorate the beneficial effects of K_{ATP} channels openers and thus prevent myocardial preconditioning, increase infarct size, and reduce time before ischemic contracture develops. A newer sulfonylurea, glimepiride may be more effective in treating diabetes mellitus due to its lower binding affinity for K_{ATP} channels in cardiac cells which suggests that ischemic preconditioning can be maintained with pre-treatment of this drug. To further investigate the effects of glimepiride on myocardial preconditioning, brown adipose tissue-derived stem cells were pretreated with glimepiride and glipizide and then exposed to hypoxia for a period of 18 hours. The mean number of surviving cells appeared to be greater in those cells pre-treated with glipizide when compared to the control. However, statistical analysis revealed that glipizide or glimepiride had no effect on myocardial preconditioning. Further study should be conducted to look at the effects of sulfonylureas on myocardial metabolism as well as action potentials which also seem to play an important role in preconditioning.

Biomedical and General Engineering
(No Abstracts Submitted)

Botany

PHYLOGENY OF THE LEGUME GENUS *ARACHIS* USING NUCLEAR AND PLASTID SEQUENCE INFORMATION. <u>S.A. Friend</u>[1], D. Quandt[2], & K.W. Hilu[1]. [1]Dept. of Biological Sciences, Virginia Tech., Blacksburg, VA 24061and [2]Rheinische Friedrich-Wilhelms-Universität, Nees-Institut für Biodiversität der Pflanzen, Meckenheimer Allee 170, D-53115, Bonn, Germany. The peanut genus *Arachis* L. (Fabaceae) contains 80 species and is native to South America. Krapovicaks and Gregory (1994) divided *Arachis* into nine sections based on morphology, geographic distribution and cytogenetics: *Arachis,Caulorrhizae, Erectoides, Extranervosae, Heteranthae, Procumbentes, Rhizomatosae, Trierectoides*, and *Triseminatae*. The largest of these, section *Arachis*, has been further subdivided into three genomes (A, B, and D) based on cytogentics. While this genus contains the crop peanut, a

comprehensive phylogeny for *Arachis* is lacking. Sequence information from plastid *trn*T-*trn*F and nuclear ITS from a total of 47 species representing all nine sections have been used to reconstruct the first molecular phylogeny for the entire genus, with *Chapmannia* and *Stylosanthes* as outgroup. Our results from ITS sequences show that the allotetraploid species *A. hypogaea* and *A. monticola* contain alleles that represent the proposed A and B genome progenitors, *A. duranensis* (A) and *A. ipanensis* (B). The sections *Caulorrhizae* and *Triseminata* are monophyletic, thus validating these sections. *Arachis macedoi* (section *Extranervosae*) is the first branching lineage, while the remaining species of this section are resolved in a terminal clade. Majority of the *Arachis* species are resolved in one of three main clades. The terminal clades (*Arachis* I and II) are comprised of section *Arachis* species and other sections placed within these.

STUDIES OF THE HEPATICAE AND ANTHOCEROTAE ALONG HAZEL RUN IN ALUM SPRING PARK, FREDERICKSBURG, VA – COMPARISON OF SAMPLING METHODS. Stephen W. Fuller & Emily Noordhuizen, Dept. of Biological Sciences, Univ. of Mary Washington, Fredericksburg, VA 22401. Initial sampling, carried out in the fall of 2008, used a complete sampling strategy to determine what liverworts and hornworts live in this habitat. To insure that the survey was as exhaustive as possible, it was repeated. In the spring of 2009 a stratified random sampling method was used on the same stretch of the stream to determine the comparative amount of labor involved and how efficacious this method would be in finding these species. The fall sampling was done to identify species which could be observed on botany field trips, whereas the spring sampling objective was to decrease the time and effort involved in sampling the entire course of the Hazel Run creek. Twelve species of liverworts and hornworts were found in the complete sampling, which required approximately 27 hours of field work. The random sampling technique revealed 8 species; it required about 8 man-hours to measure the strata, and about 20 man-hours of additional field work to locate the random collection sites and examine them for potential specimens. The stratified random sampling in the second survey proved to be less complete and just as time consuming as the complete sampling protocol; therefore, stratified random sampling would not seem to be a method of choice if one were interested in maximizing the number of liverwort and hornwort species found in this type of habitat, or in decreasing the effort involved in a survey of these plants.

A FLORISTIC SURVEY OF THE SMITH CREEK RESTORATION AREA IN ROCKINGHAM COUNTY, VIRGINIA. Karl V. Gorzelnik & Conley K. McMullen, Dept. of Biology, James Madison Univ., Harrisonburg, VA 22807. A floristic survey is being conducted as part of an ongoing collaborative project to monitor various aspects of a stream restoration project. The study area lies along part of Smith Creek in Rockingham County, Virginia. The intent of this project is to survey and catalogue vascular plants as a former pasture is being reclaimed. The results from the present survey will ultimately be compared with those obtained during later stages of the restoration, with the expectation of seeing an increase in diversity over the years. Plants are being collected and identified, and voucher specimens are being mounted

and stored at the James Madison University Herbarium (JMUH). From March 2008 through April 2009, 94 species have been collected and identified to species (32 families, 73 genera). Of these 94 species, 46 are native and 48 are introduced.

THE *FLORA OF VIRGINIA* PROJECT: A 2009-2009 UPDATE. Marion B. Lobstein, Dept. of Biology, Northern Virginia C.C., 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. A second Gwathmey Trust grant and one from the Robins Foundation have been awarded to the project 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 170 of the 201 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 74% complete and the third and final step of species genus descriptions is 52% completed. The projected publication date is late 2012 or early 2013.

PLEOMORPHIC CHLOROPHYTES: A CHALLENGING PHENOMENON IN SPECIES SYSTEMATICS. Harold G. Marshall, Dept. Biological Sciences, Old Dominion Univ., Norfolk, VA, 23529-0266. The identification of chlorophytes is commonly based on standard keys that portray a representative figure and its dimensions. It is assumed that features given are stable and are major criteria used in identification. However, these illustrations commonly come from preserved field samples showing one stage in the species life cycle. Any deviation from these features has often led to establishing a new species, or varieties and forms of an existing species. Yet many of these taxa are pleomorphic, having multiple forms with morphological features that differ from the standard illustration in identification keys. To know these stages living specimens have to be studied. Unfortunately, little is known regarding the life cycle of many of these taxa, and life stages from a variety of chlorophytes have been mis-identified. These life cycle stages are under genetic control, with interaction from a variety of environmental factors (e.g. water temperature, nutrient concentrations and ratios, light intensity, predation, and other water quality variables) influencing the onset and duration of this development, indicating phenotypic plasticity is common among the chlorophytes. The study of living specimens and their life cycle is necessary to recognize this variability, plus the use of molecular genetic protocols to verify speciation among these taxa.

DARWIN'S GALÁPAGOS PLANT COLLECTIONS. Conley K. McMullen, Dept. of Biology, James Madison Univ., Harrisonburg, VA 22807. From 15 September to 20 October 1835, while serving as naturalist aboard HMS *Beagle*, Charles Darwin was

presented with an opportunity to collect plants from four islands within the Galápagos archipelago (Chatham, Charles, Albemarle, and James). Although not the first scientist to take plant specimens from the archipelago, Darwin nonetheless collected more specimens from more islands than his predecessors. It was these collections that Darwin sent to his botanical mentor John Stevens Henslow, who later passed them on to Joseph Dalton Hooker for study and publication in the first Flora of the Galápagos Islands. In fact, Darwin's collections comprised approximately 75% of Hooker's *An enumeration of the plants of the Galápagos Archipelago; with descriptions of those which are new*, which was published in 1847. Darwin's collections proved useful not only in the development of his theory on the formation of new species, but also in the relatively young discipline of plant geography.

PRELIMINARY STUDIES OF FLORAL ANATOMY OF *physalis* (SOLANACEAE). Paige E. Miller & W. John Hayden, Dept. of Biology, Univ. of Richmond, 23173. Near-anthesis flower buds of the tomatillo, *Physalis philadelphica* (syn.: *P. ixocarpa*), and a weedy relative, *P. pubescens*, were studied via light and scanning electron microscopy using standard techniques. Buds, flowers and fruits of *P. philadelphica* are larger than those of *P. pubescens*, but otherwise, the two species are structurally similar. Calyx consists of five fused sepals that are persistent and accrescent through fruit development. The rotate corolla consists of five fused petals each bearing a dark spot near the throat. Uniseriate trichomes, both glandular and eglandular, occur on surfaces of both perianth whorls. There are five stamens; basally, filaments are adnate to the corolla. Filaments are vascularized via a single amphicribral bundle. Anthers are tetrasporangiate, bilocular, and longitudinally dehiscent. The anther wall consists of a persistent epidermis, and a well-marked endothecial layer that varies from one to three cell layers thick; neither middle layers nor tapetum was observed in near-anthesis anther walls. The gynoecium consists of two fused carpels, the ovary region of which encloses two locules and large axile placentas bearing numerous ovules. The thickened base of the ovary wall functions as a nectar-secreting disk/nectary. Ovules are anatropous and unitegmic. Continuing studies will focus on the floral vascular system, as well as details of anther wall and ovule development.

THE POWER OF GENES IN UNDERSTANDING BIODIVERSITY: THE ROSIDS. Dipan H. Oza, Sunny S. Crawley, Chelsey M. Black & Khidir W. Hilu, Department of Biology, Virginia Tech, Blacksburg, VA 24060. We are assessing here the phylogenetic signal of genomic regions with different modes of evolution in resolving biological diversity using the "rosids" as a case study. The rosids are the largest lineage in flowering plants (angiosperms), comprised of about 70,000 species of diverse biological forms. Molecular phylogenetics brought the rosid families together from traditionally diverse angiosperm subclasses in a rather heterogeneous assemblage. We examine here the phylogenetic signal in two types of genomic regions that differ in rate of nucleotide substitution: 1) three rapidly evolving regions (*matK*, *trnK* intron , and *matR*), and 2) two slowly evolving genes (*atpB* and *rbcL*). When trees based on slowly and rapidly evolving genomic regions are compared, both displayed a similar amount of resolution but support for the nodes was significantly higher with the rapidly evolving regions. Using sequence information from all five genomic regions, the

support increases compared to the slowly evolving genomic regions alone, but quite similar to that obtained with the rapidly evolving genomic regions alone. Therefore, this study shows that rapidly evolving genomic regions provide more phylogenetic signal for resolving relationships among the rosids than the traditionally used slowly evolving regions.

HYDROPHILIC AND LIPOPHILIC ANTIOXIDANT CONTENT IN FIVE TROPICAL SPICES. Rachel E. Pence and Michael H. Renfroe, Dept. of Biology, James Madison Univ., Harrisonburg, VA 22807. Dietary sources of antioxidants are important as part of healthy diets because antioxidants are thought to help prevent various chronic diseases and provide multiple health benefits. We analyzed the antioxidant content of five tropical spices: allspice, cinnamon, cloves, ginger and nutmeg. Antioxidant content was measured using the $ABTS/H_2O_2/HRP$ decoloration method, and means were compared using a one-way analysis of variance followed by Dunnett's T3 test for significance of differences of means. Cloves had the greatest hydrophilic antioxidant content but the least lipophilic antioxidant content. Lipophilic antioxidant content was greatest in allspice, while the hydrophilic antioxidant content of allspice was second only to cloves. Ginger was relatively low in antioxidants compared with the other spices. Total antioxidants was greatest in cloves. Studies of antioxidant content in spices can provide information helpful to planning healthy diets.

ISOLATION AND CHARACTERIZATION OF LEAF ENDOPHYTES IN BETULA UBER AND BETULA LENTA. Jessica D. Weaver & Kevin G. Jones, Univ. of Virginia's College at Wise, Wise VA 24293. Although originally described as a distinct species, *Betula uber* is now regarded as a variant of *Betula lenta*. A ubiquitous characteristic of angiosperms is that their healthy tissues show symptomless internal colonization by fungi called endophytes. The purpose of this research is to initiate a survey of the endophyte complement of *Betula uber* and *Betula lenta* and to investigate the effects of leaf shape on endophyte colonization since theses trees differ markedly only in leaf form. Surprisingly, gross morphology of the fungi revealed that there were no common endophytes between *Betula uber* and *Betula lenta*. There is great diversity in endophyte populations within and between these species; but, our results may simply reflect the natural diversity of endophytes. Because there is such diversity, no conclusions about the effects of leaf shape can be made at this time, and more samples need to be collected and analyzed. (Supported by the Virginia Academy of Science).

Chemistry

THE ENZYMATIC ACTIVITY OF MshA: A FUNDAMENTAL ENZYME IN MYCOTHIOL BIOSYNTHESIS. T. W. Boshers & 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. MshA is a glycosyltransferase that catalyzes the transfer of GlcNAc from UDP-GlcNAc to

inositol-1-phosphate to form GlcNAc-Ins-1P and UDP, a key step in the biosynthesis of mycothiol. We are working towards the biochemical characterization of recombinant MshA from *M. smegmatis* and *M. tuberculosis*. MsMshA has been expressed in *E. coli* and purified using amylose resin. We have developed an HPLC-based assay to measure MshA activity, and have used this assay to demonstrate that the recombinant MshA from *M. smegmatis* is active. We will use this assay in the future to characterize the chemical mechanism of MshA.

HYDROXAMATE FORMATION IN SIDEROPHORE BIOSYNTHESIS. S.W. Chocklett & P. Sobrado, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. The proliferation of many microorganisms depends heavily on their ability to scavenge nutrients from their host and extracellular spaces. Since iron is an essential nutrient, microbes have developed a tightly regulated system to sequester iron and utilize this element for its metabolic needs. Like many other pathogens, *M. tuberculosis*, *P. aeruginosa*, *B. cepacia* and *A. fumigatus* synthesize and secrete low molecular weight ($M_r < 2000$) Fe^{III} chelators called siderophores under iron-limiting conditions. Pathogens then specifically take up the siderophores complexed with ferric iron, thereby increasing the concentration of iron to levels necessary for pathogens to proliferate during infection. The assembly-line process of siderophores has revealed that a critical step in siderophore biosynthesis involves the hydroxylation of the terminal amino group from an amino acid by a flavin-dependent monooxygenase at the expense of NAD(P)H and O_2. The hydroxylated product from this reaction is then incorporated into the backbone of the siderophore, where it directly coordinates ferric iron. Here, we report the characterization of two enzymes catalyzing the initial step in siderophore biosynthesis in the prokaryote *Mycobacterium smegmatis*, as well as the fungus *Aspergillus fumigatus*. This is the first report of members of the NMOs containing a bound FAD cofactor upon purification, assisting in the detailed biochemical characterization of this class of flavoprotein monooxygenases.

METHOD DEVELOPMENT FOR THE DETERMINATION OF AMINO ACID IN SEXUALLY MATURE *Odocoileus virginianus* BY GAS CHROMATOGRAPHY MASS SPECTROMETRY. S. H. Clift, J. N. Watson, D. Swale, M. Houck, L. S. Webb, & G. C. Klein, Dept. Of Biology, Chemistry and Environmental Science, Christopher Newport University, Newport News VA 23606. The purpose of this study is to develop a method that can be used to quantify the amino acids present in a sample of muscle tissue from *Odocoileus virginianus* using Gas Chromatography Mass Spectrometry (GC-MS). Because amino acids are multifunctional, they are difficult to analyze by a single technique; however, they can be derivatized using *N*-tert-butyldimethylsilyl-*N*-methyltrifluroacetemide (MTBSTFA). This derivatizing agent attaches to amine nitrogens and carboxylate oxygen sites on the amino acids, and create suitably volatile compounds for use with GC-MS. Fragmentation occurs at similar cleavage sites for all amino acids, allowing for quick and easy identification of each of the separated peaks in the gas chromatogram. Currently, data are being collected for derivatized standard amino acids at different concentrations in order to provide calibration data for the application of this method. These techniques will be used to

quantify amino acids extracted from the muscle tissue of sexually mature *Odocoileus virginianus*.

COMPETITION BETWEEN SUBSTITUTION AND ELIMINATION IN THE REACTIONS OF DIANIONS WITH SUBSTITUTED AND CYCLIC ALKYL HALIDES. Keyanna Conner, Renan Joviliano, Andrew Alexander & Scott Gronert, Department of Chemistry, Virginia Commonwealth University, Richmond , VA 23284-2006. The competition between substitution and elimination in the nucleophilic reactions of alkyl halides is an important testing ground for reactivity patterns in gas-phase organic chemistry. The dianions in the study employ sulfonates as inert, spectator ionic sites and phenolates or benzoates as the nucleophilic ionic sites. They were generated in the gas-phase by ESI in an LCQ ion trap mass spectrometer. Using a custom-built interface, alkyl chlorides or bromides were introduced into the helium buffer gas of the instrument. Reactions were monitored as a function of time at various flow rates (pressures) of the reagent gases and branching ratios were determined. Reactions were modeled computationally at the MP2/6-31+G** level and the results aid in the interpretation of the experimental data. Three groups of alkyl halides were examined. Alkyl chlorides with electron-withdrawing groups at the beta position produced strong activation of the elimination pathway. Investigations using cyclic alkyl bromides indicated the balance between substitution and elimination are sensitive to ring size with a large shift from substitution to elimination in the move from cyclopentyl to cyclohexyl bromide. A series of six bromopentanes produced widely varying substitution patterns at both the alpha and beta carbons.

DENSITY FUNCTIONAL THEORY STUDIES OF DIARYLAMINOSTYRYL CHROMOPHORES WITH HETEROCYCLIC AND VINYLENE BRIDGES. Courtney E. Dula & Edmund Moses N. Ndip, Chemistry Department, Hampton University, Hampton, VA 23668. Organic systems with large 2PA cross-sections have a broad spectrum of technological applications, i.e. Organic Light Emitting Diodes. Organic semiconductors, like the ones studied, show strong nonlinear optical properties due to the presence of delocalized electrons in the $\pi \rightarrow \pi^*$ orbitals. These materials are ideal for fast processing of information and optical data storage applications. The linear absorption spectra, energy gaps, intensities and/or oscillator strengths, dipole moments, and other molecular properties have been computed at semi empirical and ab initio levels of theory. The computed λ_{max} for the thiophene compounds (423-437nm) are in good agreement with the experimental data (405-438nm). Additional calculations have been carried out for analogous compounds based on the success of the previous calculations. These are the first quantum mechanical studies that have been performed on these types of thiophene, furan, and pyrrole heterocyclic centrosymmetric systems. The data show reasonable agreement between Arguslab (ZINDO-CI) (398-420nm) and TITAN (DFT: B3LYP – 6-31G**) (421-512nm) λ_{max}. However, the band gaps that were extracted from the B3LYP calculations (1.16 - 2.02eV) are more consistent with experimental values (2.81-3.07eV) for the thiophene compounds.

RELATIVE STABILITIES OF C_{94} AND C_{94}^{2-} IONS USING QUANTUM AND STATISTICAL MECHANICAL FUNCTIONS. Tim Fuhrer, & Harry C. Dorn,

Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061. C_{94} is one of many larger cage fullerenes being studied today. Previous experiments and calculations have found the C_{3v} symmetry empty cage for C_{94} to be unstable, but when $M@C_{94}$ (M = Ca, Tm) was synthesized in our lab and an independent lab in China, only the C_{3v} isomer is found. Quantum and statistical mechanical calculations show that the C_{3v} cage may be stabilized by the addition of the two electrons donated by the metal atom while the other more stable empty cage isomers are destabilized by the addition of those two electrons.

OXIDATION OF ALCOHOLS USING ALUMINA BOUND PCC UNDER HETERO-GENEOUS REACTION CONDITIONS, Kristen Jobes, Heather Robinson, & Emma Goldman, Department Of Chemistry, University of. Richmond, Richmond VA 23173. Our research project involves studying heterogeneous high temperature (100-200?C) gas/solid reactions. Previously substitution and elimination reactions using metal alkoxides have been studied. Our recent focus is specifically on oxidizing alcohols with PCC under the heterogeneous high temperature gas/solid reaction conditions. The successful oxidation of these alcohols provides data to support heterogeneous gas/solid reactions as a viable alternative reaction method. The adoption of the heterogeneous method in laboratories will reduce the wasteful use of solvents and help laboratories move towards the goals of Green Chemistry.

METHOD DEVELOPMENT FOR THE QUALITATIVE DETERMINATION OF PETRO-PORPHYRINS OF TWO GEOGRAPHICALLY DISTINCT CRUDE OILS BY UV-VIS SPECTROSCOPY. G.C. Klein, K.J. Anderson, R.G. Saller, & M.A. Beasley, Dept. Of Biology, Chemistry and Environmental Science, Christopher Newport University, Newport News VA 23606. Petroporphyrins are metal-containing biomarkers found in crude oils that are known to deactivate catalysts during the refining process. Quantification of petroporphyrins in crude oils will lead to efficient removal procedures increasing the overall production of petroleum products. Fractionation schemes were investigated to increase the overall recovery yield of the heavy crude oil. UV-Vis Spectrophotometry was used to screen each of the fractions for the presence of petroporphyrins. The use of the continuum-removal by division mathematical model assisted in the identification of these petroporphyrins by increasing the definition of the associated peaks. Petroporphyrins were found in 4 of the 6 fractions of our separation scheme. UV-Vis Spectrophotometry can be used not only as a means to screen fractions for the presence of petroporphyrins, but also can be used to potentially provide information on the type of crude oil (light vs. heavy).

POST-TRANSLATIONAL MODIFICATIONS OF MODEL PROTEINS WITH 4-HYDROX-YNONENAL, A QUANTITATIVE ANALYSIS OF REACTIVITY AT SPECIFIC SITES. Qingyuan Liu and Scott Gronert, Dept. of Chemistry, Virginia Commonwealth University, Richmond VA 23284-2006. HSA was incubated with 4-hydroxynonenal (HNE) in PBS at molar ratios (HNE:HSA) ranging from 5:1 to 100:1 from 1 to 24 hours. The adducts were stabilized with sodium borohydride, digested with trypsin. The tryptic peptide mixtures were labeled with one of four iTRAQ reagents and then combined with other labeled samples. We performed two general

types of experiments to probe the kinetics of the reaction system. In the first, varying ratios of HNE/HSA were employed with a fixed reaction time of 3 hours. In the second, a high ratio (100:1) was used and measurements were taken at several times. The latter allowed us to probe slower processes. Kinetic data were obtained for 17 modification processes. The one free cysteine in HSA is highly reactive and in general, the histidines are more reactive than lysines. However, there is a large variation in reactivity among the histidines in HSA. Aside from the free cysteine, we find the following order of reactivity in the more reactive sites: His^{312} > His^{534} > Lys^{549} > His^{91} > His^{266}/His^{271} > Lys^{375} > His^{391} (Swiss-Prot). The results suggest that reactions occur on multiple time scales, possibly including protein conformational changes, and this is a likely cause for the differences in previous reports.

A COMPARATIVE STUDY OF THE NON-LINEAR OPTICAL PROPERTIES OF A SERIES OF PUSH-PULL DIARYLAMINOSTYRYL CHROMOPHORES WITH HETEROCYCLIC VINYLENE AND AZO BRIDGES. <u>Edmund Moses</u>, <u>N</u>. <u>Ndip</u> & Courtney E. Dula, Chemistry Department, Hampton University, Hampton, VA 23668. In the present study, a number of molecular descriptors (linear absorptions, dipole moments, transition dipoles, hyperpolarizabilities, etc.) have been computed for several series of diarylaminostyryl heterocyclic (thiophene, furan, and pyrrole-based) chromophores with vinylene and azo bridges at the semi-empirical (Arguslab ZINDO-CI) and ab initio (DFT/B3LYP using Gaussian98, Spartan06, and Titan) molecular orbital methods. The influences of terminal substituents on various molecular properties of the homologues were also examined. The HOMO/LUMO surface renderings show a greater population in the HOMO orbital stretching toward the terminal substituents in the azo compounds, the vinylene compounds show a decrease in the size orbitals on the benzene ring. The LUMO for the vinylene compounds show an increased population of the lobes around the benzene, whereas in the azo compounds the sizes of the lobes have decreased. When azo bridges were substituted for the vinylene bridges in the compounds an increase in the absorption maxima were observed (vinylene 421-512nm, azo 485-528nm). The increased electron density and electrostatic potential from the azo bridge suggests that the bridge substitution from vinylene to azo improves the conduction (exhibit stronger NLO properties) properties of these materials.

CHARACTERIZATION OF *Aspergillus fumigatus* UDP-GALACTOPYRANOSE MUTASE. <u>Michelle Oppenheimer</u> and Pablo Sobrado, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. UDP-galactopyranose mutase (UGM) catalyzes the conversion of UDP-galactopyranose (UDP-Galp) to UDP-galactofuranose (UDP-Galf). UDP-Galf is then used for the addition of galactofuranose to the cell wall of *Aspergillus fumigatus*, where it plays a key structural role. Deletion of *A. fumigatus* UGM (AfUGM) results in attenuated virulence. In addition, Galf is absent in humans therefore AfUGM is considered an ideal therapeutic drug target for the treatment of aspergillosis. UGMs are also unique because of their novel chemical mechanism, in which the flavin must be reduced yet no net redox change occurs throughout the reaction. Studying the mechanism, as well as, the structure of AfUGM will provide valuable knowledge which can be used for the generation of new drugs for the

treatment of aspergillosis. Currently, we have been able to successfully recombinantly express and purify, crystallize, and initially characterize AfUGM, setting the stage for the future mechanistic studies and development of therapeutic drugs.

DIASTEREOSELECTIVE α-ALKYLATION OF CHIRAL β-BORYLATED ESTERS. Michael Perfetti & Webster Santos, Dept. of Chemistry, Virginia Tech, Blacksburg, VA 24061. The use of boron in the development of asymmetric methodologies and inhibitor synthesis has increased significantly over the last decade. Currently, the use of chiral boronic esters to enhance the stereochemistry of molecules through intramolecular diastereoselective alkylations is absent in the literature. We report the development and initial characterization of a novel intramolecular diastereoselective reaction for the α-alkylation of chiral β-borylated esters. We propose that standard deprotonation of chiral β-borylated esters with lithium diisopropylamide (LDA) leads to the formation of an intramolecular cyclic five-membered ring boron-"ate" complex. Upon treatment with an alkylation reagent, this complex will collapse to provide chiral α, β-substituted boronic esters with a high degree of diastereoselectivity. This reaction is powerful in that a wide range of chiral β-borylated ester substrates can be employed that possess varying degrees of substitution and steric bulk. Results show that yields up to 67% are achievable with diastereomeric ratios (DR) of (9.7:1), where alkylation products from bulkier tert-butyl esters provided higher DR values compared to methyl esters that possessed the same β-functional groups. Additionally, several ^{11}B NMR techniques were used to investigate and elucidate the mechanism of this reaction.

GROUP 5 BACTERIAL MULTICOMPONENT MONOOXYGENASES. R. Robinson, M. Oppenheimer, J. Llanos-Velázquez, S.W. Chocklett & Sobrado, P., Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. Microbes that contain multicomponent monoxygenase systems can use organic compounds such as tetrahydrofuran (THF) or propane as the sole carbon and energy source. The ability to metabolize these compounds is related to the activity of the Group V Bacterial Multicomponent Monooxygenases (BMMs). Members of the Group V BMMs share the same operon orientation and conserved components, which consist of: *i*) a hydroxylase with an α catalytic subunit and a β structural subunit, *ii*) an oxidoreductase, and *iii*) a regulatory subunit to prevent futile cycling. The oxidoreductase is responsible for transferring electrons from NADH, through its FAD and 2Fe-2S cluster, to the diiron center of the hydroxylase. The reduced hydroxylase then reacts with molecular oxygen leading to the formation of a high-valent iron-oxo species, which is required for the hydroxylation of the substrate. We present the results of the cloning, expression, purification, and biochemical characterization of the recombinant forms of ThmD and PrmC from *Pseudonocardia* sp. Strain K1 and *Gordonia* sp. Strain TY-5. These are the oxidoreductase components of the *thm* and *prm* operons, for which the operon has been isolated from these organisms. Also reported is the expression, purification and crystallographic studies of ThmC and PrmD, the regulatory domains of each operon, respectively

MODIFICATION OF MACROPOROUS SILICA THIN FILMS VIA METAL NANO-PARTICLE DEPOSITION. Amy E. Rue & Maryanne M. Collinson, Dept. Of

Chemistry, Virginia Commonwealth University, Richmond VA 23284-2006. Two methods were used to deposit metal nanoparticles into the cavities of sol-gel derived silicate thin films created from polystyrene sphere templates. The first method followed a bottom up electrochemical approach, where films were formed on glassy carbon electrodes from a 0.4μm polystyrene sphere doped sol prepared from the condensation of tetramethoxysilane (TMOS). Since pinholes in the film were filled by electrodeposition of TMOS, the only available surface for electrochemistry was at the bottom of the cavities. Copper was then electrodeposited into the exposed cavities. Changes in the deposition length resulted in variation in particle size. The second method used a top down approach for the electrolessdeposition of gold. Similar films were formed on glass, and the deposition occurred as a result of the attraction between prepared gold nanoparticles and a monolayer of (3-Mercaptopropyl)trimethoxysilane. To insure the placement of the gold only occurred in the cavities, the exposed film was blocked with octyltrimethoxysilane or trimethylchlorosilane before template removal. Films were characterized using atomic force microscopy. Measurements were taken before and after deposition, and showed the presence of copper particles ranging from 100 to 300 nm and gold particles ranging from 70 to 100 nm.

SUBUNIT INTERACTION OF THE CLONED HUMAN GUANINE-7-METHYLTRANSFERASE. 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 the guanine base is methylated in the N-7-position generating a fully functional cap structure. If the cap is not methylated at the N-7 position, the mRNA is not translated. The enzyme that methylates the N-7 position, Guanine-7-methyltransferase, has been expressed as a His-tag protein in *E. coli*. and 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. The elutants from the Nickel column were applied to Mono-Q columns and eluted with increasing concentrations of KCl. A major methyltransferase peak eluted at 0.1 and 0.15 M KCl and was over 95% pure as determined by SDS polyacrylamide electrophoresis. This purified guanine-7-methyltransferase was then applied to a FPLC-Superose 12 gel exclusion column to characterize the subunit structure. 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

IR AND NMR OF ALCOHOLS IN THE VAPOR PHASE: A COMPARISON BETWEEN EXPERIMENTAL RESULTS AND DENSITY FUNCTIONAL CALCULATIONS. C.C. White & T.C. DeVore, Dept of Chem. and Biochem., MSC 4501, James Madison University, Harrisonburg VA 22807. The observed IR and NMR spectra of the methanol, ethanol, 2-propanol and 2-methyl, 2- propanol (t-butanol) vapor molecules are compared to the spectra calculated for these molecules using the DFT-B3LYP method with the 6-311++G (3df, 3pd) basis set using the

Gaussian 03 software. NMR spectra were calculated using the GIAO method. IR spectra (4000 to 400 cm^{-1} at 0.5 cm^{-1} resolution) were obtained by injecting 10 µL of the alcohol into a 10 cm pathlength stainless steel vacuum cell place in the sample compartment of a Nicolet 6700 FTIR. Vapor phase NMR spectra were obtained by placing 0.15 mL of the alcohol in the outer tube of a standard 5 mm OD double NMR tube. A Bruker Spectrospin 400 and a Bruker Spectrospin 600 NMR equipped with a variable temperature probe were used to collect the NMR spectra. D_2O was placed in the inner tube as the lock solvent. While the calculated chemical shifts were in qualitative agreement, the quantitative values varied by $\pm$ 0.2 ppm when adjusted to the same reference. The IR frequencies showed a decreasing error at the lower frequency. Since the calculations give the harmonic frequency, part of this difference may result from ignoring the anharmonic terms. The relative intensities generally agreed within a factor of 2.

SIZE TUNABLE HIERARCHICAL POROUS STRUCTURES BY DIRECT TEMPLATING. Bo Zhao, & Maryanne Collinson, Dept. of Chemistry, Virginia Commonwealth University, Richmond VA 23284-2006. Materials with bimodal porosity are of great interest in a diversity of applications of separation, catalysis, and sensing system. In this work, hierarchical porous materials were made by colloidal crystal templating with "raspberry" and "strawberry" shaped templates. These monodispersed hierarchical templates were prepared by simply coupling polystyrene beads of different sizes together. Both the "center" and "satellite" spheres can be varied, and the coverage of "satellite" spheres on the surface of the "center" sphere is tunable by reducing the coupling speed. Based on the templates, bimodal hierarchical porous silica monoliths and gold films were fabricated by sol‑gel templating method and electrodeposition, respectively. The materials possess adjustable and well-defined bimodal pore sizes with interconnected windows. In this presentation, the synthesis and applications of these unique materials will be discussed.

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, VA.   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, VA. 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

INCORPORATING LEARNING STYLES INTO A SCIENCE LECTURE COURSE. Lisa S. Webb, Christopher Newport University, Department of Biology, Chemistry and Environmental Science, 1 University Place, Newport News VA 23606. Learning is a complex and highly individualized process that can, and does, occur in a variety of modalities. Students can learn visually, through pictures, diagrams, charts, animations and reading; they can learn aurally, through listening to lectures, discussions, music and conversations; they can learn in a tactile manner, through manipulation of a three-dimensional model or tracing the shape of a graph with their fingers; and they can learn

in any combination of these, or other, ways. Because teaching and learning are complementary processes, effective instruction must occur via multiple pathways and incorporate multiple modalities, the choice of which should be driven by student learning preferences. In my lecture courses, I ask students to take a free, online assessment of their learning styles (www.vark-learn.com) and turn in the results for a quiz grade. This informs students of their own learning style(s) and preference(s) and gives them the opportunity to develop strategies to exploit these in preparing for class and studying for exams. It also informs me, the instructor, of the learning preferences of the students, which allows me to plan instructional strategies intended to actively and effectively engage my students in the process of learning.

APPLICATION OF THE INTERACTIONAL MODEL OF CULTURAL DIVERSITY TO IDENTIFY DIVERSITY CLIMATE FACTORS ASSOCIATED WITH ORGANIZATIONAL EFFECTIVENESS IN ACCREDITED U.S. PHYSICAL THERAPIST EDUCATION PROGRAMS. Elizabeth F. Giles, School of Physical Therapy, Old Dominion University, Norfolk, VA 23529. This work evaluated the effectiveness of the Interactional Model of Cultural Diversity as a theoretical framework to identify *diversity climate* factors associated with *organizational effectiveness* in accredited U.S. physical therapist education programs (N=151; RR=83.9%). A descriptive cross-sectional research design examined two model constructs. Cronbach's alpha coefficients were .82 for the IAPCC-R and .78 for the perception of diversity climate scale adapted from The Diversity Survey. Only 43% of all study programs reported excellent diversity climates. Pearson chi-square results (alpha=0.05) showed statistically significant construct relationships. A Kruskal-Wallis test and a post-hoc analysis determined statistically significant program group differences in minority graduates based on faculty diversity. Perception of *diversity climate* scale score was a significant predictor of number of minority graduates and percent minority graduates. Multiple logistic regression models were significant for predictors of number of graduates (p=.000; Nagelkerke's R^2=.336), number of minority graduates (p=.000; Nagelkerke's R^2=.534; .334), and percent minority graduates (p=.000; Nagelkerke's R^2=.562; .347). The Interactional Model of Cultural Diversity was effective in modeling these construct relationships in accredited U.S. physical therapist education programs.

RE-CREATING A SCIENCE MUSEUM FOR THE 21ST CENTURY. Richard Conti, Science Museum of Virginia, Richmond, VA. The Science Museum of Virginia is the Commonwealth of Virginia's flagship institution for informal science learning. Established in the early 1970s, the museum is undergoing a process to reinvent itself for the 21st century. For the past six months, the museum has undergone an extensive process to engage its constituents and reinvent itself to become a more contemporary, dynamic and relevant institution. Challenges to this process include reaching the entire state with limited resources, managing a network of satellite museums and competing with numerous entities for the discretionary time of our audiences.

CONJECTURAL INDUCTIVISM AND MATHEMATICAL PROOF. W. Michael Gentry, Department of Mathematics, Mary Baldwin College, Staunton, Va 24401.

Given sufficient time and incentives students can and will discover that none of the integers 11, 111, 1111, 1111, etc. is a perfect square. Using modulo 4 arithmetic, this conjecture is not ifficult to prove making it a theorem, indubitably true forever. Not all conjectures are created equal. Students are also able to provide copious inductive evidence that combining the processes of multiplying any odd positive integer by 3 and adding 1, and dividing any even positive integer by 2, always seems to dead end in the sequence 1, 2,4, 1,2, 4, 1,2,4, 1,2,4, etc. However, this conjecture, despite the best efforts of the mathematical community, has not been proven. Is there a pedagogical approach that lends itself to helping students in substantive ways to follow the yellow brick road to provable conjectures, and not venture off into the Land of the Giant of Despair where dragons and nearly unprovable conjectures lurk?

Environmental Science

THE EFFECTIVENESS OF WETLAND MITRIGATION BANKS IN THE LOWER RAPPAHANNOCK WASTERSHED THROUGH MAPPING AND CREATION OF A SINGLE DATABASE. Brittany A. Baker, Michael L. Bass, Earth and Environmental Sciences, University of Mary Washington, Fredericksburg, VA. Wetlands are a precious environmental resource that provide habitat, prevent pollutants and excess sediments from entering large water ways, and control storm surge. Wetlands may be destroyed in the process of commercial, residential and infrastructure development. Federal regulation requires that these wetland losses must be mitigation, through wetland mitigation banking. Wetlands mitigation banking creates a large area of wetland acreage where portions, measured in credits, are sold to those who have destroyed wetland areas. In the United States Army corps of Engineer's Norfolk district, there are several wetland mitigation banks. Information about each of these banks may be obtained on their RIBITS database. On this database, however, it is difficult to compare attributes of different wetland mitigation banks within the same service watershed. The purpose of this study is to explore the effectiveness of the wetland mitigation banks that service the Lower Rappahannock Watershed by creating a single database for easy comparison and visualizations that may drive future wetland mitigation bank development decisions.

IMPACTS ON TWO STREAMS CAUSED BY DEVELOPMENT IN THE CELEBRATE VIRGINIA NORTH PROJECT. Katherine Vrobel, Earth and Environmental Science Department, University of Mary Washington, Fredericksburg, VA. This study observed and assessed damage to streams located within the Celebrate Virginia North development in Stafford County, Virginia. Research was conducted at seven stations located on England run and the Unnamed Tributary streams. Assessments were made based on the study of the macrobenthic communities, water chemistry comparisons (such as nutrients, dissolved oxygen, conductivity, alkalinity, and water hardness) before and after rainfall, suspended load in the stream water, and gain size analysis in the water column and sediment. This study consisted of a number of methods: Water quality was assessed by determining the abundance and diversity of macrobenthic organisms, which included the Hilsenhoff Family Biotic Index (HBI) and the total percent of insect orders Ephemeroptera, Plecoptera, and Trichoptera

(%EPT) in the biotic community. Water chemistry date, such as dissolved oxygen, conductivity, and temperature, were determined using the YSI Model 85 multimeter. Samples of streams water were collected to determine nutrient levels, alkalinity, hardness, and particle size; particle size; particle size was ascertained with a Coulter counter, and water quality was assessed using LaMotte chemistry kits. Total dissolved solids and total suspended solids were determined by filtering samples from each stream before and after rain, and a gain size analysis was conducted on sand that had accumulated in Stream 5's bed. Results indicate that stream quality is declining rapidly due to the large influx of sediment from the nearby development, which is adversely affecting water quality and smothering macrobenthic communities. A negative relationship is present between the embeddeness in the macrobenthic habitat caused by sediment erosion from the development activities and the health of the streams' macrobenthic communities.

MONITORING THE STORMWATE MANAGEMENT PONDS OF CENTRAL PARK AND DEVELOPMENT OF AN OFFSITE WETLAND MITIGATION PROGRESS. Katherine Oldham and Michael L. Bass, Earth and Environmental Science, University of Mary Washington, Fredericksburg, VA. When Silver Company built the commercial complex of Central Park in the 1990's, 6.9 acres of the wetlands were destroyed. The EPA requires that the equivalent area of destroyed wetland has to be reconstructed. In compliance with the Clean Water Act, wetlands were constructed in two areas; benches around the storm water management ponds located within Central Park, and an off-site constructed wetland in Spotsylvania County. The off-site wetland was impacted by nearby developments. The storm water management ponds receive runoff from Central Park while the off-site wetland receives runoff from a new housing development. Water chemistry tests were performed on both sites, testing for nitrate, phosphate, total alkalinity, total hardness and pH levels. Temperature, dissolved oxygen, and conductivity were measured with an YSI multi meter. The nitrate, phosphate, total alkalinity and total hardness were performed in the lab using LaMotte testing kits. Samples were taken before major rainfall as well as after storm events in order to examine the impact of runoff from the development. Identical water chemistry tests were performed on the off-site constructed wetland as well as a nearby natural wetland. In addition to water chemistry tests, a survey of woody stems was done on the off-site wetland in order to determine the number of woody stems per acre. The wetland was divided into two sections, and each section was marked off in 100 foot increments with string. 20 foot squares were constructed on either side of the 100 foot markers to create a grid. Within each square the number of woody stems over one foot in height were counted and classified. In addition, wetland professional Bill Sipple aided in identifying herbaceous plant species and creating a list of those species. Soil cores were taken along the 100 foot markers in order to assess the hydric soil prevalence which is substantial.

COMPARING CLIMATE RESPONSES IN TWO TREE SPECIES OF MOUNT VERNON, VA. Brittany Miller & Daniel L. Druckenbrod, Biological and Environmental Sciences Dept., Longwood University, Farmville, VA 23909. This research investigates the relationship between tree growth and precipitation for two

common long lived species in the eastern deciduous forest. Using tree ring cores of select Mount Vernon Virginia pine (*Pinus virginiana*) and white oak (*Quercus alba*) collected in June 2008, we crossdated annual ringwidths with divisional climate data overlapping back to the year 1895. Significant correlations were found between precipitation and tree ring growth using COFECHA, ARSTAN, and DendroClim 2002 programs in conjunction with precipitation data from the National Oceanic and Atmospheric Administration. It was determined that June's precipitation was most important to Oak growth, and May and prior September precipitation was most important to Pines.

FOREST COVER CHANGE OF HISTORICAL MOUNT VERNON FROM 1793 TO 1994. Heather M. Carty & Daniel L. Druckenbrod, Biological and Environmental Sciences Dept., Longwood University, Farmville, VA 23909. During European settlement the forests were heavily logged and farmed, stripping the majority of all the forest lands in eastern North America (Foster and Motzkin 1998). However, by the mid 19th century with the rise of the Industrial Revolution, the decline of agriculture, and forest use the forests of North America have increased in area and in age (Foster and Motzkin 1998). This means that currently in the United States there is more forest cover than there has been since European settlement. Although this may be the case for the entire eastern seaboard, this study hypothesizes that the current forest cover of Mount Vernon is smaller than during George Washington's era due to human impact and development. The conclusions from this research support the hypothesis. The forest cover of Historical Mount Vernon has decreased since Washington's era. This GIS project uses a survey of Mount Vernon drawn by George Washington, a Civil War topography map, a 1933 topography map, and current aerial photos of Mount Vernon. All illustrate forest cover for its time period and use the Universal Transverse Mercator NAD 1983 coordinate system (zone 18). The two historical maps and the 1933 topography map were georeferenced against the aerial photos. George Washington's hand drawn map is the most accurate map that was georeferenced to the aerial photo, the 1933 topography map was the second most accurate, and the Civil War Map had the largest error. After overlaying all three maps with the aerial photo only 44 Acres of Washington's original 2,300 Acres of forest land remains consistently forested.

A PROPOSAL TO ESTABLISH A NATIONAL MUSEUM OF ENVIRONMENTAL SCIENCE. Richard S. Groover, J. Sargent Reynolds Community College, Richmond, VA. It is proposed that a National Museum of Environmental Science be established at a four-year institution in Virginia. Such a museum should include a small public exhibit on environmental science issues, an environmental persons Hall-of-Fame, a collection of first edition books on the science of the environment, up-to-date reports on environmental conditions, working documents from those persons who advanced the science and concerns about the environmental issues, artifacts from early environmental movement activities, and audio-visual interviews with early pioneers of the environmental movement and environmental science. The Museum physical plant would include a library, storage space for artifacts and documents, staff office space and a meeting facility for symposia.

BASELINE WATER QUALITY ASSESSMENT USING BENTHIC MACROINVERTEBRATES IN HIATT AND LICK RUNS, OPEQUON CREEK WATERSHED, FREDERICK COUNTY, VIRGINIA. Marie R. Dahl[1], Jared B. Davis[1], Andrew G.M. Fisher[1], L. Brandon Millholland[1], J.W. Pangle[2], Sean G. Robertson[1], Jeremy D. Tovar[1], & Woodward S. Bousquet[1], [1]Environmental Studies Department, Shenandoah University, Winchester, VA 22601 and [2]Opequon Creek Targeted Watershed Grant. In 1996, the Virginia Department of Environmental Quality placed Opequon Creek in Frederick and Clarke Counties on its Impaired Waters List because it failed to meet water quality standards for aquatic life and *E. coli* bacteria. Shenandoah University student researchers sampled benthic macroinvertebrates (BMIs) at six locations in the Hiatt-Lick Run subwatershed of Opequon Creek in May and October 2008. Methods and analysis conformed to the EPA's Rapid Bioassessment Protocols (RBPs) and the Virginia Stream Condition Index (VSCI) manuals, respectively. The VSCI is an eight-metric index based on the biodiversity, pollution tolerance and ecological niches of the BMIs collected in each sample. The mean VSCI score for the 11 samples was 43.5 on a 100-point scale, an overall water quality rating of "moderately stressed". VSCI scores for 8 samples fell into the severely or moderately stressed category, 2 were rated fair, while only 1 was rated good. This study provides provide baseline data and a sampling framework to evaluate proposed watershed improvements under the TMDL (Total Maximum Daily Load) Implementation Plan for Opequon Creek.

LOST CRAB-LOST CULTURE: ENVIRONMENTAL AND CULTURAL CHANGES RELATED TO THE FRESHWATER CRAB, *POTAMON* IN GREECE. Eugene G. Maurakis[1,2,3] and David V. Grimes.[3] [1]Science Museum of Virginia, 2500 W. Broad St., Richmond, VA 24542, [2]Biology Dept., University of Richmond, VA 23173, [3]VA Dept. of Environmental Quality, Richmond, VA 23060. Objectives are to generate phylogenetic relationships and biogeographic hypotheses of four freshwater crab species of *Potamon* in Greece; and comment on the need to protect their habitat. *Potamon* in the Balkan peninsula and islands in the Mediterranean region is a monophyletic group composed of two main clades: Clade 1 (*P. fluviatile* and *Potamon algeriense*) and Clade 2 (*P. ibericum* and its sister group composed of *Potamon rhodium* and *Potamon potamios*). Vicariant events (e.g. marine transgression and regression, orogeny, volcanism) are hypothesized as major factors shaping distributions of *Potamon* species in the region. We recommend an increase in environmental education and communication among older and younger generations, agriculturalists, politicians, policy writers, land developers and economists to create an understanding for the need to protect land and aquatic environments that harbor unique species and the potential benefits for economic activities such as ecotourism.

BASELINE FOR CLIMATE CHANGE: MODELING FISH SPECIES DIVERSITY IN WATERSHEDS. Eugene G. Maurakis[1,2,3], Summer Schultz[1], and David V. Grimes[1]. [1]Science Museum of Virginia, 2500 W. Broad St., Richmond, VA, 23220, [2]Biology Dept., University of Richmond, and [3]Dept. of Environmental Science and Policy, George Mason University. Objectives are to model fish species richness, diversity and evenness in watersheds of Quantico Creek (a pristine undisturbed

drainage) and Cameron Run (a highly developed urban drainage) using biological (e.g. macroinvertebrate richness and abundance, allochthonous detritus concentration), and physio-chemical factors (e.g. pH, temperature, stream order, width, depth, current, flow, elevation, gradient, river km, substrate composition, land use, and human population per intra-drainage stream order area. To date, 30 species of fishes representing 10 families, including *Channa argus*, the snakeead fish, have been collected from 23 sampling sites over a 6-month period of the two-year study. Funded by U.S. Department of Energy grant DE-FG0208ER64625.

GIS GAP ANALYSIS OF FRESHWATER AQUATIC RESOURCES (FAR) AND FRESHWATER PROTECTED AREAS (FPA) IN GREECE. David V. Grimes[1] and Eugene G. Maurakis.[2,3,4] , [1]Virginia Department of Environmental Quality, 4949 – A Cox Rd., Richmond, VA 23060, [2]Science Museum of Virginia, 2500 W. Broad St., Richmond, VA 24542, [3]Biology Dept., University of Richmond, VA 23173, and [4]George Mason University. Objectives are to quantitatively inspect overlays of FAR and FPA to determine their percent coincidence; Describe the current level of FAR protection in Greece; and Develop practicable recommendations for increasing FAR protection. Spatial analysis of ring buffered FPA, intersected with collection point data for freshwater fishes and the freshwater crab *Potamon sp.* (FAR), was used to determine the frequency of occurrence of FAR relative to the distance of collection from FPA. Pearson correlation coefficients indicate there is little correlation between the frequency of FAR collection and the distance of the collection point from FPA. Targeted sampling of FPA is needed to determine if FPA in Greece are providing the requisite levels of protection for FAR, particularly fishes listed as extinct, critically endangered, endangered, threatened or vulnerable. We recommend targeted sampling of FPA, urban, rural, resort, agricultural and other land use areas as well as the inclusion of other environmental and anthropogenic variables into a GIS GAP analysis of FAR in order to fully identify their protection needs and environmental quality indicator status.

Materials Science
(Met with Astronomy, Math & Physics)

Microbiology and Molecular Biology
(Met with Biology)

Medical Sciences

AUTOLOGOUS PLATELET GEL: A NOVEL TREATMENT FOR MYOCARDIAL INFARCTIONS (HEART ATTACK). C. W. Gurnee[1,2], B.Y. Hargrave[1,2], S.J. Beebe.[1] & X. Shu[1], [1]Frank Reidy Research Center for Bioelectrics, Norfolk VA 23510 and [2]Old Dominion University, Norfolk VA 23529. Autologous Platelet Rich Leukocyte Plasma (PRLP) or "platelet gel" as it is sometimes called is a platelet/leukocyte rich concentrate made from the whole blood of a patient. PRLP, when applied to soft tissue wounds, enhances healing by placing a high concentration of growth factors (released from platelets activated by a known platelet activator) at the site of damage. We examined PRLP in the rabbit heart after Acute Myocardial Infarction (AMI) and reperfusion and tested its ability to support and/or improve mechanical left ventricular function. *In Vitro* study: In the rabbit Langendorff heart treated with PRLP (injected into the myocardium of the left ventricle) and exposed to global ischemia there was a shift in systolic and diastolic pressure curves suggesting less systolic and diastolic dysfunction compared to the saline treated controls. The PRLP treated but not the saline treated hearts were capable of increasing left ventricular work function to a level above baseline after 40 min of reperfusion. *In Vivo* study: Fourteen days after an AMI, the rabbit heart treated with PRLP (injected into the myocardium of the left ventricle) at the time of the infarct was stressed with dobutamine and was capable of increasing left ventricular positive dP/dt and decreasing negative dP/dt compared to the saline treated heart. PRLP supports mechanical left ventricular function in the rabbit heart following AMI. These preliminary data suggest that PRLP, injected into the myocardium may function to regulate left ventricular pressures and improve function following AMI.

GENE EXPRESSION OF *SACCHAROMYCES CEREVISIAE* EXPOSED TO COMMERCIAL WOOD PRESERVATIVES BY DNA MICROARRAY ANALYSIS AND RT-PCR. Madison M. Stevens & Consuelo J. Alvarez, Dept. of Biol. and Environ. Sciences, Longwood Univ., Farmville VA 23909. Creosote and pentachlorophenol (PtCP) are commercial wood preservatives regulated by the EPA because of their toxicity to wildlife and their possible role as human carcinogens. This baker's yeast was used as a model system to observe changes in gene expression after exposure to these compounds. Cells were exposed to a creosote concentration of 50ng/ml and to a PtCP concentration of 50μM. A total of 20 DNA microarray chips were tested (7 creosote chips, 7 PtCP chips, and 6 solvent chips (used as controls)). 27 genes from creosote and 180 genes from PtCP were found to have significant changes in expression and among them, 15 genes' RNAs were chosen for reverse transcription and RT-PCR to validate their change in expression. In both experimental treatments, genes with roles in cell cycle regulation, drug transport, and response to stress had significant changes in expression. Clustering analysis revealed highly correlated gene expression in genes associated with mitotic controls. Because creosote and PtCP have been indirectly linked to causing cancer in humans, BLASTn and BLASTp analysis on the National Center for Biotechnology Information (NCBI) website was used and confirmed that some genes with significant changes in expression had homology to human genes and protein sequences. Overall, the results of this study are a sign of the necessity for more studies to be done by the EPA and workers' health associations in

order to establish job/health regulations and it could be a starting point for R-1 institutions that concentrate their research in cancer studies.

MBD2 REGULATED CANDIDATE GENES FOR MODULATION OF HUMAN GAMMA GLOBIN GENE EXPRESSION IN ADULT ERYTHROID CELLS. Merlin N. Gnanapragasam[1], Jeremy W. Rupon, Shou Zhen Wang[4], Latasha C. Redmond[1], Omar Y. Mian[3], Catherine I. Dumur, C.I[5], Kelly J. Archer[5], Joyce A. Lloyd[1] & Gordon D. Ginder[1,2,4] Departments of [1]Human and Molecular Genetics, [2]Internal Medicine, [3]Microbiology and Immunology, [5]Pathology, [5]Biostatistics, [4]Massey Cancer Center, Virginia Commonwealth University, Richmond, VA 23298. Reexpression of the silenced fetal γ-globin gene in adult erythrocytes of individuals with β-globin disorders such as sickle cell anemia and β-thalassemia, is of therapeutic interest due to its ameliorating effects[1-5]. We have previously shown that knock out of methyl CpG binding domain protein 2 (MBD2) in transgenic mice carrying the human beta globin gene cluster (β-YAC mice), results in de-repression of γ globin gene expression in adult erythrocytes. However, MBD2 does not directly bind to the γ-globin gene to mediate its silencing. We hypothesize that MBD2 may suppress human γ globin gene transcription in adult erythrocytes by an indirect mechanism ie., by binding to and repressing transcription of intermediary gene/s which may be involved in γ globin gene regulation. Microarray assays were performed on Affymetrix GeneChip® 430A 2.0 array for protein coding genes using RNA from four MBD2-/- and wild type mice adult erythroid cells. Growth factor receptor bound protein 2-associated protein1 (GAB1) and Zinc finger and BTB domain containing 32 (ZBTB32) were identified as priority candidate genes. Functional studies indicate that overexpression of these validated candidate genes can cause reexpression of γ-globin gene in Chemical Inducer of Dimerization dependent β-YAC mouse adult bone marrow cells.

THE PREVENTION OF EPILEPTOGENESIS THROUGH CALCIUM MODULATION IN A HIPPOCAMPAL NEURONAL CULTURE MODEL OF STATUS EPILEPTICUS-INDUCED ACQUIRED EPILEPSY. Nisha Nagarkatti, Laxmikant S. Deshpande & Robert J. DeLorenzo, Dept. of Neurology, VA Commonwealth Univ, Richmond VA 23298. Currently, no treatment exists to prevent the development of acquired epilepsy (AE) following injury such as status epilepticus (SE). In this study, the ability of a new drug, carisbamate, to prevent the development of spontaneous recurrent epileptiform discharges (SREDs) and alter intra-neuronal Ca^{2+} levels ($[Ca^{2+}]_i$) following in vitro SE was evaluated. After treatment in low-Mg^{2+} containing solution to mimic SE, neuronal cultures developed SREDs (in vitro AE). Cultures were treated, post-SE, with carisbamate (200 µM) for 12 h. The drug was then washed out of the system and neurons were evaluated for the expression of SREDs 24 h post-washout. Drug-treated neurons failed to display SREDs, in contrast to the controls. The ability of carisbamate to block elevations in $[Ca^{2+}]_i$ after SE was also tested because alterations in Ca^{2+} dynamics and homeostatic mechanisms have been associated with plasticity changes and ultimately, the development of epilepsy. Following SE, sustained elevations in $[Ca^{2+}]_i$ were observed and carisbamate was able to lower $[Ca^{2+}]_i$ when administered post-SE. When evaluated for the ability to restore Ca^{2+} homeostasis following glutamate challenge, the drug-treated neurons showed

enhanced recovery. This study suggested that carisbamate is able to prevent the development of SREDs in vitro; furthermore, the ability of carisbamate to alter Ca^{2+} dynamics may contribute to its anti-epileptogenic properties. Supported by: NIH grants RO1NS051505, RO1NS052529, UO1NS058213 and AHA Pre-doctoral fellowship.

MODELING PHYSICAL ACTIVITY IN WORKING ADULTS: HOW SUITABLE IS THE EXPANDED PARALLEL PROCESS MODEL?. A. B-H-Sam [1], M. L. Walker [2], S. Plichta [1], and G. Maihafer [2]; [1]School of Community and Environmental Health, College of Health Sciences, Old Dominion University and [2]School of Physical Therapy, College of Health Sciences, Old Dominion University. The usefulness of the Expanded Parallel Process Model in predicting health enhancing physical activity is assessed in the context of risk for coronary heart disease. The study involves secondary analyses of a dataset from a group of working adults who elected first to participate in a health plan 'Quality Improvement Study' and were then randomly selected to receive an intervention program designed to increase activity. Data on self-reported demographics, physical activity levels, health status characteristics and perceptions measured on a Likert-type scale known as the Risk Behavior Diagnosis Scale are analyzed. The Risk Behavior Diagnosis Scale measures represent the model hypothesized mediating variables which are perceived severity, perceived susceptibility, perceived response efficacy and perceived self-efficacy. Results of data analyses offer limited and weak support for use of the Expanded Parallel Process Model to explain differences in health enhancing physical activity behavior of working adults. The magnitude of the hypothesized Expanded Parallel Process Model mediator variables observed in the study, though small, may suffice as a call for further research using a different research approach (longitudinal). Health behavior is complex, and the most important determining factors of physical activity may also not have been included in the analysis. A different theoretical model, in this case, may help to explain physical activity behavior.

PATTERNS OF ETHANOL-RESPONSIVE GENE EXPRESSION IN FYN KINASE KNOCKOUT MICE. Sean P. Farris & Michael F. Miles, Dept. of Pharmacology & Toxicology, Virginia Commonwealth University, Richmond, VA 23298. The molecular mechanisms underlying alcoholism are largely unknown, however, changes in gene expression are proposed as critical molecular adaptations leading to the development lasting ethanol related phenotypes. Two inbred mouse strains with divergent ethanol related behaviors, DBA/2J (D2) and C57BL/6J (B6), also exhibit differing basal and acute ethanol-responsive gene expression patterns among discrete brain regions including prefrontal cortex (PFC). Bioinformatic analysis of D2 and B6 microarray studies implicated Fyn kinase as a potential mechanism regulating ethanol-responsive myelin gene expression. *Fyn* knockout (KO) mice have abnormal CNS myelination and are more sensitive to ethanol related behaviors. Using DNA microarrays we assayed *Fyn* KO mouse PFC to identify downstream basal and acute ethanol-responsive gene expression patterns. Characterizing the associated gene networks will test the hypothesis that Fyn is required for acute ethanol regulation of myelin gene networks, and identify novel *Fyn* related signaling mechanisms. Microarray analysis revealed 565

genes altered by genotype, and 746 genes altered by ethanol (P<0.001). Several genes with a functional relationship to myelin including progesterone receptor (*Pgr*) were regulated by ethanol in Fyn KO PFC, suggesting a novel relationship may exist between Fyn and Pgr in regulating ethanol-responsive myelin gene expression. Continued investigation of this functional relationship and associated gene networks may aid in the future development of more successful pharmacotherapies for alcoholism and related CNS myelin toxicity.

NANOSECOND PULSED ELECTRIC FIELDS INDUCE APOPTOTIC-LIKE CELL DEATH IN MURINE E4 SQUAMOUS CARCINOMA CELLS BY MULTIPLE MECHANISMS. Wei Ren & Stephen J. Beebe, Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk VA 23510. Nanosecond pulsed electric fields (nsPEFs) are pulses with ultra-short duration (ns), high power (mega watts), but low energy density (mJ/cc), which are distinctly different from conventional-electroporation pulses. NsPEFs have emerged as a novel method to modulate intracellular structures and functions. To determine the signaling pathways in nsPEF-induced cell death, murine E4 squamous carcinoma cells were exposed to multiple pulses from 0 to 60kV/cm with 300ns duration. Cell death occurred with decreases in the mitochondria membrane potential, the appearance of active caspases, and the release of cytochrome *c* from the mitochondria into the cytoplasm. Using a cell permeable, irreversible inhibitor, the appearance of active caspases was observed within1 hour post pulse. At lower electric fields, active caspases appeared in the apparent absence of cytochrome *c* release. However, at higher electric fields cytochrome *c* release was observed. Using irreversible inhibitors of active caspases, active caspase-8, caspase-9 as well as caspase 3/7 were seen within 2 hours post pulse in an electric-field dependent manner. In addition, inhibition of caspase activity using z-VAD-fmk partially attenuated cytochrome *c* release. These results suggest that nsPEFs induce an apoptotic-like cell death as indicated by using both mitochondria-dependent and –independent mechanisms in E4 cells.

METHYL BINDING DOMAIN PROTIEN 2 (MBD2) MAINTAINS TUMOR SUPPRESSOR SILENCING AND PROMOTES EPITHELIAL DEDIFFERENTIATION IN BREAST CANCER. O.Y. Mian, M. N. Gnanapragasam, S. Z. Wang & G. D. Ginder, Massey Cancer Center, Richmond, VA 23298. Methyl-CpG Binding Proteins (MCBPs) function as interpreters of epigenetic signals encoded in the genome. We study the function of Methyl-Binding Domain Proteins (MBDs) in human mammary epithelial cancers, where repatterning of CpG methylation is common. We find Methyl Binding Domain Protein 2 (MBD2) promotes abnormal multi-cellular morphology of tumor cells grown in extracellular matrix extracts. Stable MBD2 knockdown in MCF7 cells leads to an increased proportion of differentiated epithelial structures (e.g. acinii, 70%, [CI=0.55-0.83]) when compared with untransfected (46%, [CI=0.39-0.53], $p \leq 0.038$) and scrambled shRNA transfected (37%, [CI=0.29-0.45], $p \leq 0.012$) control cells. To identify the genes underlying this MBD2 dependant phenotype, high throughput quantitative PCR data were probed using self organizing map (SOM) analysis. We found a small subset of the breast cancer specific

tumor suppressors known to be silenced by promoter hypermethylation were regulated by MBD2 (n=7, 15%). The MBD2 dependant genes were rapidly re-suppressed upon rescue with a shRNA binding site variant MBD2 and ChIP studies confirmed binding of MBD2 at genes within the MBD2 dependant cluster. We demonstrate MBD2 maintains aberrant dedifferentiation in breast cancer through a network of epigenetically inactivated tumor suppressor genes. Based on these findings, we intimate a pathologic role for MBD2 in the initiation and progression of human mammary epithelial neoplasia. This work was supported by NIH-2R01DK029902-26A2

NEUTROPHIL INFILTRATION AND RELEASE OF REACTIVE OXYGEN SPECIES ENHANCE VASCULAR REACTIVITY TO ANGIOTENSIN II VIA THE RhoA KINASE PATHWAY. Nikita Mishra, MD, Scott Walsh, PhD, OB/GYN/Physiology, VCU, Richmond,VA 23298. Women with preeclampsia have enhanced vascular reactivity to Angiotensin II (Ang II). We hypothesized that neutrophil release of ROS enhances vessel reactivity to Ang II by activating the RhoA kinase pathway. Resistance arteries from omental fat biopsies of normal pregnant patients undergoing C-sections (n=20) were studied. Ang II dose response (10^{-9}M to 10^{-5}M) was done. The Ang II dose response was repeated with neutrophils ($2000/mm^{3}$) in the vessel lumen. Ang II + neutrophils was repeated with addition of superoxide dismutase (150 U/ml)/catalase (5000 U/ml) to quench ROS or with addition of Y-27632 (3µM), a specific Rho A kinase inhibitor. Ang II dose response was also tested with ROS generating solution (hypoxanthine, 0.36mM + xanthine oxidase, 0.004 IU/ml), Ang II + ROS + SOD/catalase or Ang II + ROS + Y-27632 (3µM). Ang II caused a dose response contraction with maximum response at 10^{-6}M (Change in diameter of -18.6 ± 2.0m, mean ± S.E). With activated neutrophils, vasoconstrictive response to Ang II was significantly greater at 10^{-9}M, 10^{-7}M, 10^{-6}M and 10^{-5}M (-44.5 ± 5.9m, p<0.01). SOD/catalase and Y-27632 significantly blocked the enhanced response to Ang II by activated neutrophils. Similar results were observed with ROS. These results suggest that neutrophil infiltration in systemic vasculature of preeclamptic women explain the enhanced reactivity to Ang II in preeclampsia. HL069851.

POSITIVE ALLOSTERIC MODULATION OF α4β2 NEURONAL nAChRs BY DESFORMYLFLUSTRA-BROMINE AND ITS ANALOGS. N. A. German[1], J.-S. Kim[1], A. Pandya[2], M. Schulte[2] & R. A. Glennon[1], [1]Department of Medicinal Chemistry, Virginia Commonwealth University, Richmond VA 23298 and [2]Department of Chemistry and Biochemistry, University of Alaska, Fairbanks AK 99775. Neuronal nicotinic acetylcholine receptors (nAChRs) appear to play an important role in cognitive and attentive processes. An alteration in expression or function of α4β2 nAChRs also has been associated with neurodegenerative disorders and in certain aspects of drug abuse. Positive allosteric modulators (PAMs) have been envisioned as a potential therapeutic treatment; however there is a very limited number of compounds, if any, that have shown selective allosteric modulation of α4β2 nAChRs. A novel indole alkaloid desformylflustrabromine (dFBr), recently isolated from a marine species, has been shown to selectively modulate α4β2 nAChRs through an

allosteric mechanism. The present investigation was designed to determine structural features important for the actions of dFBr. Proposed compounds were prepared using several synthetic schemes. Biological activities of synthesized compounds were evaluated using two-electrode voltage clamp techniques employing *Xenopus laevis* oocytes injected with cDNAs of the human α4β2 receptor. As a result of this study dFBr and its synthetic analogs were shown to be positive allosteric modulators of α4β2 nAChRs and key structural features were identified for this action. [Supported, in part, by a Virginia Center on Aging grant and a VCU Department of Pharmacology and Toxicology Training Grant (T32 DA007027-34).]

THE EFFECT OF SUCRALOSE ON OBESITY AND DIABETES PROGRESSION IN A TYPE II DIABETES MODEL, THE TALLYHO/JNGJ MOUSE. Matthew C. Johnson & Dianne M. Baker, Dept. of Bio. Sci., Univ. Mary Washington, Fredericksburg, VA 22401. The high incidence of type II diabetes is one of the most pressing medical concerns in the United States. Treatment of type II diabetes commonly includes management of blood glucose and body weight through diet and exercise. To regulate blood glucose, type II diabetics often replace dietary sugars with artificial sweeteners such as sucralose (Splenda®). While sucralose is typically considered to be a safe replacement for sugar, some recent studies have found adverse effects on glucose balance and food consumption. In this study, we tested the effects of sucralose on the progression of type II diabetes in mice. We hypothesized that the presence of sucralose in the diet of type II diabetic mice would accelerate the progression of the disease, resulting in increased glucose levels compared to diabetic control animals. Secondly, we hypothesized that sucralose in the diet would increase food consumption and therefore increase body mass in type II diabetic mice compared to control-fed type II diabetic animals. To test these hypotheses, we measured food intake, body mass, and blood glucose levels (both fasting and glucose tolerance test levels) in sucralose-fed and control-fed animals over a 10 week treatment period. Plasma samples were also collected over this same period for measurement of insulin and triglyceride levels. Contrary to expectations, sucralose-fed mice had lower blood glucose and triglyceride levels than control-fed mice. Additionally, we found no significant effect of sucralose on insulin concentration, food intake or body mass. These results suggest that sucralose may slow the progression of type II diabetes.

THE EFFECTS OF Δ[9]-TETRAHYDROCANNIBINOL, THE MAJOR PSYCHOACTIVE COMPONENT OF MARIJUANA, ON FOOD AND BRAIN REWARD. M. A. Rolfes[1,2], A. J. Kwilasz[2], L. S. Harris[2], R. E. Vann[1,2], Departments of [1] Psychology, & [2] Pharmacology/Toxicology, VCU, Richmond, VA, 23298. Previous studies in rats using progressive ratio (PR) schedules of reinforcement have suggested a role for cannabinoid receptor 1 (CB1) agonists in both food consumption and feeding motivation. PR procedures that assess motivation commonly use food reinforcement, however these procedures are unable to delineate whether motivation to respond is an enhancement of feeding or reward mechanisms. Intracranial self-stimulation (ICSS), a procedure in which animals are trained to respond for stimulation of the medial forebrain bundle, is well suited to investigate motivation to respond for reward. Accordingly, the CB1 agonist, Δ[9]-tetrahydrocannabinol (THC), was assessed for its

ability to alter motivation to respond for food or brain stimulation reward (BSR). ICR mice were trained to respond for food or BSR (158 Hz, 150 μA) on a PR2 schedule of reinforcement, in which the response requirement increased by 2 lever presses after every 4 reinforcers earned. Breakpoints were assessed daily to measure motivation to respond for reinforcement and tests with vehicle and THC (1, 3, 10, and 17.1 mg/kg) were conducted. THC administration significantly increased breakpoints for food and BSR; however, breakpoint increases for BSR were observed at a higher dose than for food. Operant response rates were unaffected by THC. These results add to a growing body of literature that suggests an enhancing role for CB1 agonists in feeding and reward motivated behavior in mice.

THE DOMESTIC FOWL (GALLUS) AS A MODEL OF OBESITY AND SEX SPECIFICITY IN THE METABOLIC SYNDROME. R.P. Wyeth[1], A. Santo[1], K.E. Harris[2], T.V. Palacios[1], R.M. Lewis[3], C.F. Honaker[3] & P.B. Siegel[3], [1]Edward Via, Virginia College of Osteopathic Medicine, [2]Dept. of Human Nutrition, Foods and Exercise, [3]Dept. of Animal and Poultry Sciences, Virginia Polytechnic Institute and State University, Blacksburg. High body fat content is associated with increased morbidity and mortality. The prevalence of overweight or obese humans grows with alarming rapidity. Globally 1.7 billion people are overweight or obese producing a pandemic of cardiovascular disease (CVD). Principal risks for CVD include abdominal obesity, hyperlipidemia, dyslipidemia, hyperglycemia, insulin resistance, and hypertension, known collectively as the metabolic syndrome. The ability to define mechanisms that interact to produce the metabolic syndrome in humans is limited by lack of a single mammalian model that fulfills all criteria for this syndrome. We propose a suitable alternative. A line of chickens developed at Virginia Tech was selected for high juvenile body weight that not only exhibits rapid juvenile growth but also becomes morbidly obese unless feed restricted. Thus, these high weight chickens provide an attractive model for studying CVD associated with the metabolic syndrome. Based on the metabolic characteristics and preliminary data on these high weight chickens, by inducing obesity, we produced a sexually differentiating effect in the α_1 adrenergic response of this proposed non-mammalian model of the metabolic syndrome. This study was funded by a grant from the Harvey Peters Foundation.

THE FLAVONOID LUTEOLIN INCREASES VASODILATATION THROUGH NON-GENOMIC NITRIC OXIDE RELEASE. Hongwei Si[1], Dongmin Liu[1] & Richard P. Wyeth[2], [1]Laboratory of Molecular Nutrition, Department of Human Nutrition, Foods and Exercise, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, [2]Divisions of Anatomy and Physiology, Edward Via Virginia College of Osteopathic Medicine, Blacksburg, Virginia. Luteolin is a plant flavonoid and vasodilator. We tested if luteolin will stimulate endothelial NO synthase (eNOS) phosphorylation and decrease alpha$_1$ adrenergic (α_1AR) contraction, in cultured human aortic endothelial cells (HAECs) and isolated rat aorta. When intact rat aortic rings were constricted with the specific α_1AR agonist phenylephrine, followed by cumulative addition of luteolin, a dose dependent relaxation was produced. In rings pretreated with the eNOS inhibitor, N-nitro-L-arginine methyl ester, luteolin–induced vasorelaxation was partially blocked. When HAECs were incubated

with luteolin, luteolin phosphorylated eNOS and stimulated NO release. These data indicate that, within arterial vasculature, luteolin: 1) induces vasorelaxation through an endothelium dependent mechanism; 2) produces a dose dependent and immediate decrease in α_1AR induced contraction; 3) increases the phosphorylation of eNOS and subsequently improves NO production. Taken together, we suggest that luteolin induces vasorelaxation not by increased eNOS translation but rather by receptor-mediated stimulation of NO production by extant eNOS.

Natural History & Biodiversity

SMALL MAMMALS FROM THE CLOUD FOREST AT CERRO BOBI, SIERRA DE LOS CUCHUMATANES,GUATEMALA. Nicte Ordonez[1], Walter Bulmer[2], Ralph P. Eckerlin[2], & John O. Matson[3], [1]Dept. Biol. Sci., Texas Tech Univ., Lubbock, TX 79409, [2]Div. of Nat. Sci., Northern VA Community Coll., Annandale, VA 22003, [3]Dept. Biol. Sci., San Jose State Univ., San Jose, CA 95192. Very little is known about small mammal ecology and distribution in the highlands of Guatemala. Small mammals were removal trapped from the mixed hardwood/coniferous cloud forest at Cerro Bobi in the Sierra de los Cuchumatanes, Huehuetenango, Guatemala during July 2005 and December 2005/January 2006.The coniferous cloud forest is located at 5km SW San Mateo Ixtatan, NW side of Cerro Bobi (3110m).The habitat can be characterized as follows: overstory of fir (*Abies*), pines (*Pinus*), oaks (*Quercus*), and other broad-leaved trees. A heavy litter of moss, lycopsids, ferns, and fallen logs was on forest floor. A total of 131 individuals representing 10 species of small mammals (8 rodent and 2 shrew) was collected. The site was sampled during two distinct seasons (wet and dry). While there were small differences in the small mammal species composition and abundance between the 2 samples, this was attributed to small sample size and sampling error. *Peromyscus guatemalensis* was the most abundant species in both seasons. Especially important is the collection of the Maya mouse (*Peromyscus mayensis*), not formally reported since its original description in 1975.

IDENTIFICATION OF CRYPTIC CHLOROPHYTES THROUGH MOLECULAR SEQUENCE DATA. Matthew R. Semcheski, Todd A. Egerton & Harold G. Marshall, Department of Biological Sciences, Old Dominion University, Norfolk VA 23529. The phenomenon of phenotypic plasticity is evident in many organisms throughout the natural world and is a byproduct of the biotic and abiotic factors of the environment in which an individual or population inhabits. Plasticity is especially prominent among microscopic photosynthetic taxa, which produce a variety of ambiguous forms. We identified a number of morphologically variable specimens, all originating from a single monoculture of the chlorophyte *Scenedesmus sp*., which included single-cell spinous and non-spinous forms, along with mulitcelluar spinous and non-spinous forms. In order to discern plasticity vs. genetic variation in a number of ecomorphs of *Scenedesmus sp*., the complete ITS-1, 5.8S, and ITS-2 region was sequenced. Phylogenetic analyses confirmed that all samples analyzed, while being morphologically distinct, do indeed belong to the *Scenedesmus* genus. Upon further investigation, it was determined that at the outset, with nutrients non-limiting and an absence of predators, *Scenedesmus sp*. grew rapidly in the single-cell non-spinous form.

Over time, a population of rotifers had contaminated the *Scenedesmus sp*. cultures, triggering the production of multicelluar, spinous forms, a typical anti-predator strategy for this genus. It is then concluded that *Scenedesmus sp.* does exhibit phenotypic plasticity in response to biotic and abiotic changes in the surrounding environment. Additionally, some genetic variation was found in several other isolates from a pure *Scenedesmus sp.* culture, all of which, group within the *Scenedesmus-Desmodesmus* complex.

SALAMANDER DIVERSITY AT C. F. PHELPS WILDLIFE MANAGEMENT AREA, FAUQUIER AND CULPEPER COUNTIES, VIRGINIA. J. D. McGhee & M. D. Killian, Department of Biological Sciences, University of Mary Washington, Fredericksburg, VA 22407. Salamander guilds are important components of ecosystems, and may be declining in Virginia. Consequently baseline information on salamander diversity and abundance is needed. Our objective was to assess salamander diversity at a single site in the Rappahannock River watershed, C. F. Phelps Wildlife Management Area. We randomly selected stream and upland terrestrial sites to run 50-meter transects, for both quadrat and natural cover searches. We assessed diversity using a Shannon-Weiner index on all captures and non-larval captures, compared findings quantitatively to similar studies, and assessed diversity in on-site watersheds. We found 11 of 13 expected species, with $H' = 1.33 \pm 0.05$ SD, $J' = 0.55$, and for non-larval diversity $H' = 1.18 \pm 0.08$ SD, $J = 0.49$. The slope of captures per species was similar to other studies, $\beta_1 = -0.50 \pm 0.10$. A single watershed (Fishing Run stream) was considered more diverse than other watersheds on site. We conclude that C. F. Phelps Wildlife Management Area supports a relatively diverse salamander community, and may act as a baseline for the surrounding region. Management efforts should be focused to maintain stream structural diversity, and monitoring agricultural input.

GEOGRAPHIC INFORMATION SYSTEMS AUGMENT ECOLOGICAL MONITORING IN DAM REMOVAL PROJECT. Alan B. Griffith & Damon Lowery. Dept. of Biological Sciences, University of Mary Washington, Fredericksburg, Virginia, 22401. As dam removals have increased in frequency, due to dam deterioration and interest in ecosystem restoration, there is a growing need to determine the ecological effects of dam removal. Few studies have been conducted on dam removals and pre-dam removal data is particularly limited. We present here a case study that explores the use of Geographical Information Systems (GIS) to supplement vegetation sampling data on the ground. Our part of an interdisciplinary study aims to measure changes in distribution and abundance of vegetation after the removal of 2 earthen dams on a tributary of Holts Creek in New Kent County, VA. We previously reported results of plant distributions and abundances measured before the removal of these dams. Our sampling revealed that at least one invasive species, *Murdannia keisak* and *Microstegium vimineum* were broadly distributed and in high abundance within the dams' watershed. As dam removal proceeds, it will be essential to monitor the establishment of these invasive species and other species. Based on our current knowledge of GIS applications we 1) will visualize vegetation samples as spatially related information, 2) have gathered existing geo-referenced information for the

impacted watershed, and 3) have uncovered potentially useful spatially related information, for which no data exists. This process has led us to collect geo-referenced data that will improve our ability to monitor vegetation changes after dam de-construction.

PHYTOPLANKTON DIVERSITY TRENDS IN THE RAPPAHANNOCK, YORK AND JAMES RIVERS. Todd A. Egerton & Harold G. Marshall. Dept. of Biological Sciences, Old Dominion University. Norfolk VA 23529. The examination of the causes and consequences of biodiversity is a central tenet in ecological research. In estuarine habitats, one factor which has been shown to have an effect on diversity is salinity. Remane (1934) described the change in community composition of benthic invertebrates along a salinity gradient and the accompanying change in species richness. He observed the greatest numbers of species in the freshwater and marine portions, and the lowest in the brackish mesohaline region. This study examines the long term diversity of phytoplankton species along the Rappahannock, York/Pamunkey, and James rivers, tidal tributaries to Chesapeake Bay. These three rivers have varying levels of algal productivity and diversity, and show the same general pattern as described by Remane, with reduced species richness in the mesohaline. Additionally, there is a significant positive correlation between phytoplankton diversity and productivity, but only in the upstream, low salinity stations. This may be attributed to the large seasonal fluctuations in phytoplankton abundance in the freshwater sites, and the relative constancy of the populations in the Chesapeake Bay. This study is based on the long-term phytoplankton monitoring data, gathered as a component of the Chesapeake Bay Program.

PHYLOGENY OF THE CARYOPHYLLALES (ANGIOSPERMS): EXPLORING THE EFFECTS OF GENE CHOICE AND MISSING DATA. Sunny S. Crawley, Shelli A Newman & Khidir W Hilu, Department of Biological Sciences, Virginia Tech, Blacksburg VA 24061. Previous work on reconstructing Caryophyllales phylogeny has relied on data from two to many genomic regions, totaling 3,000 to 46,000 base pairs of sequence information. Topology, resolution, and support for the internal structure of the order have varied, but improvement has been noted as the number of genes/characters increased. We explore here the impact of gene choice and degree of missing data on tree topology and support within Caryophyllales. We chose two rapidly evolving regions (*matK* and surrounding *trnK* intron), two slowly evolving regions (*atpB* and *rbcL*) and one with an intermediate rate of evolution (*ndhF*). We supplemented new *matK/trnK* sequences with complete and partial sequences from GenBank for all genomic regions. Maximum parsimony and maximum likelihood methods were used to analyze 130 species with six basal eudicot species as outgroup. Varying degrees of missing data were analyzed as several different data partitions. The phylogenetic structure of the order recovered with rapidly evolving regions was comparable to that obtained with the three other regions. Topology and support based on combined analysis of five regions was remarkably similar to those obtained using much larger numbers of genes/characters; this was achieved despite having about 46% missing data. Combining genes of different mode of evolution and inclusion of partial

sequences resulted in both increased taxon representation and improved overall phylogenetic structure.

SPECIES RICHNESS AND SPATIAL DISTRIBUTIONS OF FISHES AT NEARSHORE HABITATS, ST. JOHN VIRGIN ISLANDS. Eugene G. Maurakis[1,2,3].[1]Science Museum of Virginia, 2500 W. Broad St., Richmond, VA 24542, [2]University of Richmond, VA 23173, [3]George Mason University, Fairfax, VA. Objectives were to identify species diversity and delineate distributions of species at sand- and boulder-shoreline beach habitats, and compare similarity of species and feeding type associations to establish a baseline at these two beach habitats. Fish species richness and spacial distributions, and habitat descriptions were surveyed by visual census using snorkel and mask at 1-m intervals from 1- 40 m from shore at 20 transects at Little Lameshur, Great Lameshur, and Francis Beach, St. John, U.S. Virgin Islands during daylight hours. A total of 69 taxa (67 species) representing 33 families of fishes were observed. Average number of species (32.7) at boulder beach habitats were significantly greater than that (24.3) at sand beach habitats. The most speciose functional feeding groups were mobile benthic invertivores (11 species at 9 m from boulder shore habitats), scrapers and piscivores (each 9 species at 6 m from boulder shore habitats), and macrocarnivores (6 species at 6 m from sand shore habitats). Total numbers of functional feeding groups (range=10-12) and species per functional feeding groups (range=29-46) at all distances from shore at boulder transects were consistently higher than those (functional group range=8-10; species=19-30) at sand transects.

A SURVEY OF STRUCTURES USED BY RAFINESQUE'S BIG-EARED BATS IN VIRGINIA (*Corynorhinus rafinesquii*). L.T. Pletcher, S. Murdock & J.D. Kleopfer, Virginia Department of Game and Inland Fisheries. The Rafinesque's Big-eared Bat, a Virginia state-endangered species, is categorized as a species of greatest conservation concern (Tier I). The objective of this study was to determine the distribution and abundance of this species by surveying man-made structures. This 2008 study continues previous inventory efforts begun by the VDGIF in 1993 which have identified individuals and colonies roosting in man-made structures, many of which had not been monitored since 2001. This study was conducted by revisiting previously documented structures and counting the number of individuals present, road cruising for potential new structures and using county GIS information to obtain landowner cooperation. Of the 94 previously documented structures, 23 were confirmed to be in good status and 15 of these had bats present. The fate of 21 structures is unknown, 14 structures have been destroyed since 2002, and 29 were known to be destroyed prior to 2001. There were 4 active maternity colonies, each containing 30 - 50 females and young. Eleven solitary roosts were documented. Approximately 200 individuals were observed, mostly in Southhampton and Sussex Counties and the City of Virginia Beach. No individuals were found in Charles City, Surry, and Prince George Counties, or the City of Petersburg. The overall population status in Virginia is unknown. Continued publicity and education are needed to enlist landowner cooperation and locate other bat roosts.

MITOCHONDRIAL DNA VARIATION IN THE EASTERN FOX SQUIRREL (*SCIURUS NIGER*). N. D. Moncrief, VA Museum of Natural History, 21 Starling Ave., Martinsville Virginia 24112 & R. A. Van Den Bussche, Department of Zoology, Oklahoma State University, Stillwater OK 74078. The eastern fox squirrel (*Sciurus niger*) occurs naturally over most of eastern North America. This species displays striking patterns of geographic variation in size and coat color. These patterns of morphologic variation are consistent with a hypothesis of southward range contraction and isolation in two refugia (in Texas and Florida) during the Last Glacial Maximum, followed by northward range expansion after the glaciers receded. Similar hypotheses have been proposed to explain the patterns in phylogeographic structure exhibited by many plants and animals in eastern North America. As part of a more comprehensive study of geographic variation in *Sciurus niger*, we analyzed a 402 bp segment of the cytochrome b (cyt b) mtDNA gene in populations throughout the species' range. Despite the broad geographic sampling in our study, there was no phylogeographic structure in our data. Unique haplotypes differed from high-frequency haplotypes by only one or two base pairs, producing a star-like phylogeny of haplotypes. Bootstrap analysis of neighbor-joining trees revealed a lack of phylogenetic structure among haplotypes. Variation within populations and within the species as a whole was characterized by high haplotype diversity and low nucleotide diversity. Taken together, our data indicate that the eastern fox squirrel underwent a rapid range expansion and rapid morphological divergence within the past 20,000 years.

Psychology

INTERHEMISPHERIC COLLABORATION: EFFECTS OF STIMULUS FORMAT AND TASK PROCESSING SIMILARITY. Urvi J. Patel, Dept. of Psych., Christopher Newport Univ., Newport News VA 23606. Observers were presented with a five stimuli array; two items above the point of fixation (one to each visual field), one item below the point of fixation (to one visual field), and two items directly above the other at the point of fixation (to both visual fields). During each experiment, observers engaged in three conditions: (1) responded to whether the bottom stimulus matched either of the top two stimuli (single primary task), (2) responded to whether the two center stimuli matched (single secondary task), and (3) responded to the primary stimuli OR to the secondary stimuli as prompted by a post-stimulus cue (dual task). While all letter stimuli were presented for Experiment 1, Experiment 2 displayed letter primary stimuli and picture secondary stimuli. Performance on the single and dual primary trials was of principal interest. The critical comparison involved trials on which the two matching stimuli projected to the same visual field (within-hemisphere trials) versus trials on which the two matching stimuli projected to opposite visual fields (across-hemisphere trials). While no difference between trials was found when the dual task involved stimuli of different format, an across hemisphere advantage was found when the dual task involved stimuli of the same format. Processing similarity of stimulus format may determine whether the benefits to spreading the processing load between the two hemispheres outweigh the costs.

ARE DIFFERENT PEOPLE SUSCEPTIBLE TO DIFFERENT DISTRACTIONS? THE RELATIONSHIP BETWEEN LEARNING STYLES AND PERFORMANCE UNDER DISTRACTING TASK CONDITIONS. Rachel R. Phillips & Poornima Madhavan, Dept. of Psych, Old Dominion University, Norfolk VA 23529. In order to examine the relationship between learning styles and performance for a complex visual search task under distracted and undistracted conditions, eighty participants completed two complex visual search tasks, one with distraction and one without (the conditions were counter-balanced). Distractions were presented either auditorially or visually, and were either verbal or spatial in nature. This was a 2 (perceptual modality: auditory vs. visual) x 2 (processing code: verbal vs. spatial) x 2 (distraction: distracted vs. undistracted) mixed design. Results for hit rates revealed that participants scoring high in the verbal dimension performed differently than those scoring high in the visual dimension depending on distraction and condition. Hit rates for those classified as sensors varied differently when distracted versus undistracted than those classified as intuitors which also varied as a result of gender. Results for false alarm rates revealed that those in the sensing dimension performed better when distracted but those in the intuiting dimension performed worse. Analyses for false alarms also revealed that males and females performed differently when distracted versus undistracted and that this varied by condition. Finally, in addition to the overall sensing and intuiting dimension differences for false alarms, this also varied with gender and distracted condition. These findings have implications for the development of training programs, computer automation, and contribute to the overall understanding of the influence of individual processing preferences on performance.

EMERGENT LEADERSHIP AND TEAM PERFORMANCE AS A FUNCTION OF TASK DIFFICULTY IN A DISTRIBUTED COMPUTER GAME-BASED ARCHITECTURE. Alexandra B. Proaps & James P. Bliss, Dept. of Psychology, Old Dominion University, Norfolk, VA, 23529. Specialized military field training can be expensive, time-consuming and dangerous. The use of computer game-based architectures may help provide a safe, controlled environment in which geographically dispersed military units (i.e., distributed) can develop decision-making and leadership skills while rehearsing a specific task, such as building clearing, area reconnaissance, or navigation. Leaders of distributed teams need to know how to perform to overcome the challenges involved in these virtual environment contexts. Current research shows there are implications of task difficulty on how distributed team members emerge as leaders within virtual environments. The purpose of the proposed study was to investigate the possible relationship between task difficulty with team task performance and emergent leadership during a team search task using a modified version of the popular video game, Half Life 2™. The experimenters determined that task difficulty decreased the speed with which the task was completed and that the gender composition of the dyad had an effect on accuracy and speed. The experimenters also found dyad members rated each other as sharing the overall contribution to the task. Dyad members did rate one member of the team as the overall leader, but their rating of leadership did not change based on task difficulty.

AN INVESTIGATION OF TRAINING INCENTIVES IN IMPORVING PERFORMANCE ON COMPLEX TASKS. Patricia C. Brennan & Poornima Madhavan, Dept. of Psyc., Old Dominion Univ., Norfolk VA 23507. Incentives not only serve as extrinsic motivation for a particular task, but also manipulate people to behave a certain way. We are interested in studying how framed incentive structures may have training implications in a visual search task such as airline luggage screening. The framed incentive structures are a representation of choices in either a positive (rewards) or negative frame (punishment) in which points are given or taken away to influence detection behavior in finding weapons across two phases – training (familiar targets) and transfer (novel targets). We are only interested in performance during transfer due to the real world implications. Participants are presented with the context of being an airport luggage screener with points for hits, misses, false alarms and correct rejections, which serve as incentive structures. The goal is to improve the design of training programs for operators in applied visual search tasks, particularly airport luggage screening. We found that providing incentives does enhance performance in maximizing hits, in which the hit-sensitive and miss-sensitive outperformed the equal-costs and no-incentives groups. However, the control group outperformed all other groups in transfer because they were able to self-train thus conjure up their own representation of a weapon. In all the control group had the highest rate of hits, highest overall confidence, lowest rate of false alarms and fastest response times.

EXAMINING THE HINDSIGHT BIAS EFFECT DURING JUDGMENTS OF TRUST. Martin D. Smith-Rodden & Ivan K. Ash, Dept. of Psychology, Old Dominion University, Norfolk, VA. 23529. The Hindsight Bias Effect (HSE) describes people's tendency to overestimate their own ability to predict an event once an event's outcome is known. HSE has been shown to be a ubiquitous, reliable, and potentially harmful retrospective judgment bias. The purpose of this research was to examine participants' evaluations of trust outcomes, to determine how judgments of trust might be susceptible to hindsight biases, in two experiments. Subjects were exposed to fictional vignettes about interpersonal trust: one about a small money loan (N=120), and in the second experiment, one depicting a small business hiring decision (N=122). To manipulate subject's surprise at outcome, stories were controlled for congruency (i.e. degree of trustworthiness of target, versus the outcome, in which the target either upholds trust or defects). Subjects were polled for their opinions on the target's trustworthiness just prior to learning the outcome, and again for their recollections of that opinion in a post-test administered exactly one week later. Results were analyzed in a 2 (pretest/post-test) X 2 (Target is trustworthy/Target is non-trustworthy) X2 (Trust upheld/ Defection) mixed design. Increased hindsight bias was observed on unexpected outcomes and no/reverse hindsight bias on expected outcomes in a significant interaction predicted by the Sense-making model of hindsight bias. However, in Experiment 1 we did not observe hindsight bias in the condition where the story's target unexpectedly failed to uphold trust. This may be because participants interpreted the failure to pay back a loan as a "non-event," as previous research has shown abated hindsight bias effects for these types of "non-event" outcomes.

ALCOHOL AND INJURY: DEFINING THE ALCOHOL PROBLEM ON COLLEGE CAMPUSES. Diane A. Kokorelis & Bryan E. Porter, Dept. of Psychology, Old Dominion University, Norfolk VA 23529. Unintentional injuries, particularly motor vehicle crashes, are the leading cause of death among 1-44 year olds. A particularly large portion of these crashes are caused by young males under the influence of alcohol. This study looks to gather and examine the knowledge and attitudes concerning alcohol and drinking and driving among students at a southeastern Virginia university in order to create an appropriate intervention on campus. Data were collected from 310 psychology undergraduates, 199 being female and approximately 55.2% being Caucasian. Multiple correlations and one regression were conducted to assess the relationship between alcohol consumption and the threat and efficacy components of the Risk Behavior Diagnosis Scale concerning the consumption of alcohol as well as drinking and driving. Results indicate that while students' levels of drinking correlate with levels of threat, the same does not hold true for their levels of efficacy. Further, CDC-classified binge drinkers feel as though their behavior does not pose a serious threat, nor do they think they can alter their drinking behaviors. The results also suggest that the more students drink, the more likely they are to drink and drive. Finally, there was no significance found between each gender's uses of a designated driver.

A THEORETICAL MODEL FOR RELIGION'S ROLE ON DOMINANCE DIFFERENCES IN GENDER. Julia R. Quigley, Dept. of Psychology, Christopher Newport University, Newport News, VA 23606. This study presents a theoretical model to explain the potential relationship between religion, gender schemas, and dominance. Social learning theories and research show that religion creates gender schemas with associated dominance differences in the sexes. The prescribed dominance patterns in the sexes could lead to unintended consequences, such as pay scale differences, anorexia, and poor academic performance.

STUCK IN THE MIDDLE WITH YOU: THE EFFECT OF BIRTH ORDER ON CREATIVITY. Laura Boettcher & Gayle Dow, Psychology. Department, Christopher Newport University, Newport News, VA 23606. Birth order has been found to play an important role in how participants perform on creativity measures. The purpose of this study was to investigate the impact of birth order (youngest, middle, and oldest) on verbal measures of creativity. Forty-one undergraduates from a liberal arts university completed a creativity assessment, specifically the Remote Associates Test (RAT), and a measure of demographics, including birth order. There was a significant main effect of birth order on creativity (middle-born out performed youngest-born).

CREATIVITY AND COGNITIVE FLEXIBILITY. Julie F. Erath & Urvi J. Patel, Dept. of Psych., Christopher Newport Univ., Newport News VA 23606. A number of studies have reported a positive relationship between creativity and cognitive flexibility. Creativity may be defined as the ability to use diverse manners of thought to generate novel and dynamic ideas and solutions. Consistent with such a mode of processing, cognitive flexibility is the ability to restructure knowledge in a manner that allows ease in task shifting. The present study was designed to investigate how this relationship may be influenced by verbal ability (i.e., vocabulary knowledge and the

ability to reason by way of such knowledge). Four verbal measures were administered to 47 undergraduate students to evaluate how the following constructs interrelate: creativity (Remote Associates Test), cognitive flexibility (self-report Cognitive Flexibility Scale), and verbal ability (Shipley Vocabulary Test and Homographs Task). Correlation analyses revealed a significant positive relationship between select measures of interest. Specifically, verbal knowledge and reasoning may influence one's ability to generate novel solutions which, in turn, may be associated with adaptability to different tasks. These results are consistent with the findings of previous studies and make a unique contribution to the literature by suggesting that verbal ability may facilitate the relationship between cognitive flexibility and creativity.

AN INVESTIGATION OF EATING PATTERNS AND WOMEN'S BODY OBJECTIFICATION. Whitney N. Kailos, Dept. of Psychology, Christopher Newport University, Newport News, VA 23606. The current study investigates the relation between college women's eating patterns and behaviors in retrospect to certain influential factors such as body objectification. Through the social comparison theory women may either objectify or subjectify their bodies leading to abnormal eating behaviors. College women presumably concern themselves with weight, body scrutiny, and social status which may encourage food restriction and eating disorders. This study used published literature to further examine women in a college setting to determine the reasons behind their eating behaviors.

ASSOCIATION STUDY BETWEEN GABA RECEPTOR GENES AND ANXIETY DISORDERS. Xuan T. Pham & John M. Hettema, Dept. of Psychiatry. Virginia Commonwealth Univ., Richmond VA 23220. Human anxiety disorders are complex diseases with relatively unknown etiology. Dysfunction of the GABA system has been implicated in many neuropsychiatric disorders, including anxiety and depression. In this investigation, we explored four GABA receptor genes for their possible associations with genetic risk for anxiety disorders. Using multivariate structural equation modeling, we selected twin subjects scoring at the extremes of a latent genetic risk factor shared by neuroticism, several anxiety disorders, and major depression from a large population-based twin sample. Our study sample consisted of 589 cases and 539 controls (n=1128), which we subjected to a two-stage association study. In stage 1, all genetic markers were screened, the positive results of which were tested for replication in stage 2. We genotyped altogether 26 single nucleotide polymorphisms (SNPs) from the four GABA receptor genes (*GABRA2, GABRG2, GABRA6,* or *GABRA3)*. Of the 26 SNPs genotyped in stage 1, we identified 2 markers in the *GABRA3* gene that met the threshold ($p \le .1$) to be tested in stage 2. These two markers, along with an additional two, failed to replicate in stage 2. Haplotype associations for this gene showed no significance across all haplotype combinations. Our findings did not show sex-specific associations for any of the markers on *GABRA3*. Our 2-stage association design did not reveal association for in anxiety disorders. The full extent to which polymorphisms in the GABA system may affect the genetic predisposition for anxiety disorders still remains to be elucidated.

TRAIN YOUR BRAIN TO BEHAVE: CLINICAL APPLICATIONS OF NEUROFEEDBACK. Kathryn. N. Hoey, Dept. of Psychology, Christopher Newport University, Newport News, VA 23606.   Neurofeedback (NF) is an operant-conditioning system, known as neuroregulation, which teaches individuals how to control or change their own brain activity. When an individual is diagnosed with a disorder that can be treated via neurofeedback, that patient can then seek out a clinical psychologist or other practicing therapist for neurofeedback treatment. The therapist will begin the treatment with a comprehensive qualitative EEG (qEEG) to gather the data necessary in order to devise a treatment program for that particular patient. Disorders that can be treated using neurofeedback include but are not limited to ADHD, cerebral palsy, migraines, and epilepsy. Each disorder is treated with specific neurofeedback protocols that target specific areas of the brain in order to achieve a specific change in brain functioning.

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 effectively 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 effectiveness 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 poststratified estimators for a population mean and a simple regression coefficient, where the poststratification take place at the full-sample level. Samples are cho- sen using differentially-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.

BEST STUDENT PAPER AWARDS

AGRICULTURE, FORESTRY, AND AQUACULTURE
Brandon Newmyer
The Anorectic Effect of Neuropeptide AF is Associated With Satiety-Related
Hypothalamic Nuclei.
Radford University

Honorable Mention
Michele Mohrmann
Nodulation Traits of Tepary Bean Inoculated with 15 Bradyrhizobial Strains
Virginia State University

**ASTRONOMY, MATHEMATICS AND PHYSICS WITH MATERIALS
SCIENCE**
Craig Hanley
Infrared emission properties of Nd: KPb5Br5 for solid-state lasers
Dept of Physics
Hampton University

Honorable Mention
Olusola Oyebobla
Concentration dependent studies of the laser-induced infrared emission from KCl-
NaCl tablets
Dept of Physics
Hampton University

Honorable Mention
Robert Brik
Quantitative Analysis of Background Radiation Particle Tracks in a Large Diffusion
Cloud Chamber Using "ImageJ" Digital Imaging Techniques.
MIT and Science Museum of Virginia

BIOLOGY WITH MICROBIOLOGY
GRADUATE
Meghan Durham-Colleran
Initial Report of in vitro Biofilm Formation in Francisella: A Role for an Orphan
Response Regulator
George Mason University

UNDERGRADUATE
V. Q. Chau
Delayed Treatment with Sildenafil Attenuates Ischemic Cardiomyopathy: Role of RhoA/Rho Kinase Pathway
Virginia Commonwealth University

BIOLOGY WITH MICROBIOLOGY
Graduate Honorable Mention
Nathan A. Bowman hm
Seasonal Patterns of Phytoplankton Populations in Back Bay, Virginia
Department of Biological Sciences, Old Dominion University

Undergraduate Honorable Mention
Madelyn G. Crowell
Natural Genetic Variation in Metabolic Rate and Activity in White-footed Mice (Peromyscus leucopus) in Relation to Genetic Variation in Reproductive Photoresponsiveness
Virginia State University

BIOMEDICAL AND GENERAL ENGINEERING
E. Heade Spratley
Computational Modeling of Varus Elbow Instability in Terrible Triad Injuries
Department of Biomedical Engineering
VCU

BOTANY
Jessica Weaver (co-author: K. G. Jones)
Isolation and Characterization of Leaf Endophytes in Betula uber and Betula lenta.
University of Virginia's College at Wise

BOTANY
Harvill Award ($150.00)
Paige E. Miller (student of John Hayden)
University Of Richmond

CHEMISTRY
S.W. Chocklett
Hydroxamate Formation in Siderophore Biosynthesis
Virginia Tech

Honorable Mention
Tim Fuhrer
Relative Stabilities Of C94 And C942- Ions Using Quantum And Statistical
Mechanical Functions
Virginia Tech

Honorable Mention
A. E. Rue
Modification of Macroporous Silica Thin Films Via Metal Nanoparticle Deposition
Virginia Commonwealth University

MEDICAL SCIENCES
Nisha Nagarkatti
The Prevention of Epileptogenesis through Calcium Modulation in a Hippocampal
Neuronal Culture Model of Status Epilepticus-induced Acquired Epilepsy
Virginia Commonwealth University

Merlin Gnanapragasam
Honorable Mention
The Role of Methyl-CpG Binding Domain Protein2 (MBD2) in the Human Fetal
Gamma Globin Gene Regulation
VCU

Carrie Gurnee
Honorable Mention
Platelet Gel: A Novel Treatment for Myocardial Infarction (Heart Attack).
Old Dominion University

Omar Y. Mian
Honorable Mention
The Methyl-Binding Domain Protein 2 (MBD2) maintains epithelial
dedifferentiation in breast cancer
VCU, Goodwin Research Lab.

NATURAL HISTORY AND BIODIVERSITY
Todd Egerton
Phytoplankton diversity trends in the Rappahannock, York, and James Rivers
Department of Biological Sciences
Old Dominion University

PSYCHOLOGY
Diane Kokorelis
Alcohol and injury: Defining the alcohol problem on college campuses
Department of Psychology, Old Dominion University

STATISTICS
S. H. Sathish Indika
Latent Model Parameter Estimation and Characterization in a Bivariate Lifetime
Distribution
Old Dominion University

VIRGINIA JUNIOR ACADEMY OF SCIENCE
MAY 28, 2009
68th ANNUAL MEETING AWARDS
VIRGINIA COMMONWEALTH UNIVERSITY
RICHMOND, VA

AGRICULTURE AND ANIMAL SCIENCE
Honorable Mention: KATHERINE CHEN
　　　　　　　　　Mills E. Godwin High School
Honorable Mention: VICTORIA S. FUBARA
　　　　　　　　　Deep Run High School
Honorable Mention: VAISHNAVI KOSURI AND DIVYA MADHUSUDHAN
　　　　　　　　　Thomas Jefferson High School for Science and Technology
Third Place: JORDAN B. HURST
　　　　　　　Chesapeake Bay Governor's School
Second Place: MATTHEW T. KING
　　　　　　　George H. Moody Middle School
First Place: TIAN ZHOU
　　　　　　Blacksburg High School

ANIMAL BEHAVIOR (ETHOLOGY)
Honorable Mention: RYAN P. CARROLL
　　　　　　　　　Yorktown High School
Honorable Mention: SEANA HEDAYATNIA
　　　　　　　　　Mills E. Godwin High School
Honorable Mention: ERICA L. STANLEY
　　　　　　　　　Central Virginia Governor's School
Third Place: ADITHYA SIMHA AND KEVIN H. SHU
　　　　　　　Thomas Jefferson High School for Science and Technology
Second Place: CARINE L. SQUIBB
　　　　　　　Southwest Virginia Governor's School
First Place: JEEIN SEO
　　　　　　Thomas Jefferson High School for Science and Technology

BOTANY A
Honorable Mention: SARAH N. BOEGNER
　　　　　　　　　George H. Moody Middle School
Honorable Mention: JAKE H. HILL
　　　　　　　　　Central Virginia Governor's School
Honorable Mention: CHRISTOPHER M. NOWAK
　　　　　　　　　George H. Moody Middle School
Third Place: ANNA M. BROSNAHAN
　　　　　　　Washington-Lee High School

Second Place: SUCHANA H. COSTA
                       Washington-Lee High School
First Place: MADHURA V. CHITNAVIS
                       Roanoke Valley Governor's School

CHEMISTRY A
Honorable Mention: SOFONIAS GETACHEW
                       Williamsburg Middle School
Honorable Mention: ANDREA E. GREEN
                       H. B. Woodlawn
Honorable Mention: JIMIN HE
                       Yorktown High School
Third Place: SAUMIL BANDYOPADHYAY
                       George H. Moody Middle School
Second Place: VIJAY GOVINDARAJAN
                       Mills E. Godwin High School
First Place: PRASANNA G. JOSHI
                       Mills E. Godwin High School

CHEMISTRY B
Honorable Mention: FARIS G. SANJAKDAR
                       Washington-Lee High School
Honorable Mention: PRIYA SARKAR
                       George H. Moody Middle School
Honorable Mention: SHANNA SU
                       Mills E. Godwin High School
Third Place: JORDYN A. WADE
                       George H. Moody Middle School
Second Place: AMANDA K. RODGERS
                       Southwest Virginia Governor's School
First Place: ANIRUDH SARASWATHULA
                       Thomas Jefferson High School for Science and Technology

COMPUTER SCIENCE
Honorable Mention: ANDREW C. CASEY
                       Central Virginia Governor's School
Honorable Mention: MICHAEL R. LEVET
                       Deep Run High School
Honorable Mention: ANDREW E. VITKUS
                       George H. Moody Middle School
Third Place: BENJAMIN M. ROBLE
                       Mathematics and Science High School at Clover Hill
Second Place: LAWRENCE TALEJ
                       Deep Run High School

First Place: BRIAN K. SEAL, JR.
                    Deep Run High School

CONSUMER SCIENCE A
Honorable Mention: DEVAN M. BITTINGER
                     Hanover High School
Honorable Mention: KIMBERLY D. CASTLEMAN AND
                     MACKENZIE G.NEWMAN
                     Deep Run High School
Honorable Mention: ARIELLE R. EFFRON
                     Mills E. Godwin High School
Third Place: JOSEPH M. DAMRON III
                     Mountain Vista Governor's School
Second Place: TARA R. DEAN
                     Southwest Virginia Governor's School
First Place: LINDSAY A. BYRUM
                     Chesapeake Bay Governor's School

CONSUMER SCIENCE B
Honorable Mention: KATHERINE B. MODLY
                     Mountain Vista Governor's School
Honorable Mention: ERIN R. VEASEY
                     Southwest Virginia Governor's School
Honorable Mention: JOSHUA J. WHITE
                     Shenandoah Valley Governor's School
Third Place: COURTNEY M. SIMS
                     Shenandoah Valley Governor's School
Second Place: PETER STEELE
                     Shenandoah Valley Governor's School
First Place: HANNAH M. MEEKS
                     Hanover High School

EARTH AND SPACE SCIENCE
Honorable Mention: NATHANIEL T. BURKHOLDER
                     Shenandoah Valley Governor's School
Honorable Mention: HANA-MAY EADEH
                     George H. Moody Middle School
Third Place: STUART D. GEIPEL
                     George H. Moody Middle School
Second Place: WILLIAM B. RIORDAN
                     Central Virginia Governor's School
First Place: BRANDEN T. KATONA
                     Mills E. Godwin High School

ENGINEERING A

Honorable Mention: KATHARINE A. GRAHAM
                     George H. Moody Middle School

Honorable Mention: MAX S. NEWMAN
                     Mills E. Godwin High School
Honorable Mention: MARY E. SEALS
                     Central Virginia Governor's School
Third Place: MICHELLE A. KENNEDY
                     Hanover High School
Second Place: CHRISTOPHER M. WERTMAN
                     Shenandoah Valley Governor's School
First Place: JOY E. LEE
                     Thomas Jefferson High School for Science and Technology

ENVIRONMENTAL SCIENCE A

Honorable Mention: REID A. BARDEN
                     George H. Moody Middle School
Honorable Mention: DICKSON R. BARRY
                     Patrick Henry High School
Honorable Mention: KATHERINE D. BAUMAN
                     H. B. Woodlawn
Third Place: KATHERINE J. ADAMS
                     Chesapeake Bay Governor's School
Second Place: KYLE F. ALLWINE
                     Chesapeake Bay Governor's School
First Place: MICHAEL A. BUGAS
                     Fort Defiance High School

ENVIRONMENTAL SCIENCE B

Honorable Mention: GRIFFIN Q. HUNDLEY
                     Hanover High School
Honorable Mention: GUFRAN H. JARRAR AND CARRIE D. CARDONA
                     Chesapeake Bay Governor's School
Honorable Mention: SARAH V. LIU
                     Roanoke Valley Governor's School
Third Place: RUTH W. HEDBERG
                     Chesapeake Bay Governor's School
Second Place: SAMANTHA L. FLOYD
                     Chesapeake Bay Governor's School
First Place: GREGORY D. DORSEY
                     Chesapeake Bay Governor's School

ENVIRONMENTAL SCIENCE C

Honorable Mention: ELIZABETH MCDONALD
                     Williamsburg Middle School

Honorable Mention: MARK D. MISCH AND JEFFREY C. DITMER, JR.
Chesapeake Bay Governor's School
Honorable Mention: BRIAN P. MURPHY
Chesapeake Bay Governor's School
Third Place: MITHCHELL J. OLIVER
Mountain Vista Governor's School
Second Place: HILLARY D. MAY AND CALEB S. SMITH
Chesapeake Bay Governor's School
First Place: SARAH G. MURPHY
George H. Moody Middle School

ENVIRONMENTAL SCIENCE D
Honorable Mention: NICHOLAS E. ROWE
Chesapeake Bay Governor's School
Honorable Mention: STEVEN K. THOMPSON
Chesapeake Bay Governor's School
Honorable Mention: MEGAN WALZ
Blacksburg High School
Third Place: ABIGAIL J. SIMON
Home Schooled
Second Place: SARA C. TAYLOR
George H. Moody Middle School
First Place: SETH J. THEUERKAUL
Chesapeake Bay Governor's School

GENETICS AND CELLULAR BIOLOGY
Honorable Mention: SWETHA PASALA
Thomas Jefferson High School for Science and Technology
Honorable Mention: CHELISSE D. PERRY
Chesapeake Bay Governor's School
Honorable Mention: ANDREW M. SHORE
Mathematics and Science High School at Clover Hill
Third Place: CONAN ZHAO
George H. Moody Middle School
Second Place: ALLISON S. REID
Central Virginia Governor's School
First Place: CAROLYN SONG
Mills E. Godwin High School

MATHEMATICS
Honorable Mention: THOMAS J. DELGADO
Mathematics and Science High School at Clover Hill
Third Place: ZACHARY TERNER
Mills E. Godwin High School
Second Place: HUNTER W. LONG
Roanoke Valley Governor's School

First Place: SOHINI SENGUPTA
                      Ocean Lakes High School

MEDICINE AND HEALTH A

Honorable Mention: QUINN L. BROGAN
                     Mills E. Godwin High School
Honorable Mention: COURTNEY O. EGAN
                     Hermitage High School
Honorable Mention: SANJAY T. KISHORE
                     Southwest Virginia Governor's School
Third Place: JACK A. BOOTH
                     George H. Moody Middle School
Second Place: CAITLIN E. DOHERTY
                     Mills E. Godwin High School
First Place: STEPHANIE A. MARQUEEN
                     Douglas Freeman High School

MEDICINE AND HEALTH B

Honorable Mention: KATHERINE A. RODRIGUEZ
                     Deep Run High School
Honorable Mention: KATELYN K. ROWLAND
                     Thomas Jefferson Middle School
Honorable Mention: LESLEY E. SUMMERVILLE
                     James River High School
Third Place: LEANDER C. UNVERDORBEN
                     George H. Moody Middle School
Second Place: ASHLEY R. TAYLOR
                     Southwest Virginia Governor's School
First Place: ANGELA C. MENNA
                     Mills E. Godwin High School

MICROBIOLOGY

Honorable Mention: SEBASTIAN T. COUPE
                     Thomas Jefferson Middle School
Honorable Mention: SAYANTANEE DAS
                     George H. Moody Middle School
Honorable Mention: ANNA E. KNIGHT AND CATHERINE F. DWORAK
                     Thomas Jefferson High School for Science and Technology
Third Place: SAMUEL M. RUBIN
                     Mills E. Godwin High School
Second Place: SAPIR CACHUM, KATHLEEN ATKATSH AND
                     MANNA FUJIU
                     Thomas Jefferson High School for Science and Technology
First Place: SANJAY M.KISHORE
                     Southwest Virginia Governor's School

PHYSICAL SCIENCE

Honorable Mention:	NICHOLAS A. PARAISO
	George H. Moody Middle School
Honorable Mention:	SHRUTI R. RAO
	George H. Moody Middle School
Honorable Mention:	MADELEINE A. SENDEK
	Swanson Middle School
Third Place:	LEONARD DUBOVOY
	George H. Moody Middle School
Second Place:	GRANT S. BROUSSARD
	George H. Moody Middle School
First Place:	PERRIN L. FALKNER
	Swanson Middle School

PHYSICS

Honorable Mention:	LAKSHMI BODAPATI
	George H. Moody Middle School
Honorable Mention:	MADELINE L. BOTTICELLO
	Yorktown High School
Honorable Mention:	CLAYTON M. GEIPEL
	Mills E. Godwin High School
Third Place:	BRANDON M. BUNCHER
	George H. Moody Middle School
Second Place:	SAMUEL C. PASSAGLIA
	Washington-Lee High School
First Place:	MUKARRAM AHMAD
	Mathematics and Science High School at Clover Hill

PSYCHOLOGY - GENERAL

Honorable Mention:	SAMUEL A. AKERS
	George H. Moody Middle School
Honorable Mention:	ADITYA P. MOTHADAKA
	Mills E. Godwin High School
Honorable Mention:	MOLLY L. ROSS
	Shenandoah Valley Governor's School
Third Place:	HALEY T. SQUIER
	Shenandoah Valley Governor's School
Second Place:	ERIK R. SIMONSEN
	Shenandoah Valley Governor's School
First Place:	COURTNEY L. YANCEY
	Shenandoah Valley Governor's School

PSYCHOLOGY - LEARNING & PERCEPTION A

Honorable Mention: ALEXANDER ALTHOFF AND CHELSEA A. MILLS
Deep Run High School
Honorable Mention: INDAY J. BARAHONA
Yorktown High School
Honorable Mention: BRANDY D. HENCE
Chesapeake Bay Governor's School
Third Place: SIBLEY A. BROWN
Southwest Virginia Governor's School
Second Place: JACKSON R. COLVER
Mills E. Godwin High School
First Place: KATHERINE L. AGNEW
Central Virginia Governor's School

PSYCHOLOGY - LEARNING & PERCEPTION B

Honorable Mention: ARAVIND MENON
Deep Run High School
Honorable Mention: ANA O'HARROW
Yorktown High School
Honorable Mention: SCOTTIE M. SMITH
Deep Run High School
Third Place: JULIA G. SHRECKHISE
Shenandoah Valley Governor's School
Second Place: CARLA M. SPENCE
Thomas Jefferson Middle School
First Place: SONIA PHENE
Washington-Lee High School

PSYCHOLOGY - SOCIAL

Honorable Mention: CHRISTOPHER D. KIME
Yorktown High School
Honorable Mention: SAMANTHA F. SPYTEK AND LARA L. SIERRA
Gunston Middle School
Honorable Mention: AMELIA J. TYLER
Southwest Virginia Governor's School
Third Place: PAUL W. DUCKWORTH
Mills E. Godwin High School
Second Place: WENHAO LU
Mills E. Godwin High School
First Place: SARA BOURDOUANE
Thomas Jefferson Middle School

STATISTICS

Honorable Mention: WILLIAM J. LUXHOJ AND JACOB L. CHAMBON
                    Deep Run High School
Third Place: TODD W. PHILLIPS
                    Mills E. Godwin High School
Second Place: ANDREW R. HOUSE
                    Deep Run High School
First Place: KATHERINE C. LARSON
                    Mills E. Godwin High School

ZOOLOGY

Honorable Mention: LAUREN E. BENNETT
                    George H. Moody Middle School
Honorable Mention: BRADY K. BROWN
                    George H. Moody Middle School
Honorable Mention: KATHRYN A. KINGSBURY AND ART T. KULATTI
                    Thomas Jefferson High School for Science and Technology
Third Place: EMILIA R. SENS
                    Washington-Lee High School
Second Place: SUSAN M. HASTINGS AND MEGHAN R. KELLY
                    Thomas Jefferson High School for Science and Technology
First Place: ALEXANDER M. KIM
                    Thomas Jefferson High School for Science and Technology

SPECIAL AWARDS

Botany Section Award, given by the Botany Section of the VAS, to the best paper on a botanical subject. ($100.00)

> MADHURA V. CHITNAVIS
> Roanoke Valley Governor's School

Speleological Society Award given to the best paper addressing karst or topics related to speleology given by the Richmond Area Speleological Society. ($50.00)

> HANA-MAY EADEH
> George H. Moody Middle School

Mathematics Award for the paper that evidences the most significant contribution in the field of Mathematics. ($200.00)

> SOHINI SENGUPTA
> Ocean Lakes High School

Statistics Award for the paper that evidences the most significant contribution in the field of Statistics. ($200.00)

> KATHERINE C. LARSON
> Mills E. Godwin High School

Smith Shadomy Infectious Disease Award in honor and memory of Dr. Smith Shadomy given by the Virginia Chapter of the National Foundation of Infectious Diseases. ($50.00)

> GREGORY THOMPSON
> Central Virginia Governor's School
> KATHERINE E. BAUMANN
> George H. Moody Middle School

Roscoe Hughes Award for the best paper in the field of Cellular Biology. ($150.00)

> CHELISSE PERRY
> Chesapeake Bay Governor's School

Rodney C. Berry Chemistry Award for the paper that evidences the most significant contribution in the field of chemistry. ($150.00)

> PRASANNA G. JOSHI
> Mills E. Godwin High School

The Dr. and Mrs. Preston H. Leake Award in Applied Chemistry will be given to the author of a research paper which best exemplifies how chemicals, chemical principles, or chemistry have been used, are used, or might be used to enhance or even to save life. ($150, $100)

Second Place	EMILY SPILLER
	George H. Moody Middle School
First Place	AMANDA K. RODGERS
	Southwest Virginia Governor's School

Catesby Jones - Russell J. Rowlett Award for the Best Research Paper of the Year. ($100.00)

> JOY LEE
> Thomas Jefferson High School for Science and Technology

Virginia Sea Grant College Program Award is given by the Virginia Sea Grant College Program for outstanding marine or coastal research. ($50.00)

> SETH THEUERKAUF
> Chesapeake Bay Governor's School

American Cancer Society Award - This award is to recognize outstanding science papers related to cancer research. A certificate to each and to 1st place - $100, honorable mentions - $50. These awards are funded by the American Cancer Society (Virginia Council).

Honorable Mention	AMANDA K. RODGERS
	Southwest Virginia Governor's School
Honorable Mention	CONAN ZHAO
	George H. Moody Middle School
First Place	PAUAN G. GUDIMETTA
	Deep Run High School

The Gamma Sigma Delta Award (Agriculture). Presented by the VPI & SU Chapter of the Honor Society of Agriculture. This award is presented in recognition of excellence in research dealing with application of new technologies and/or concepts in agriculture forestry, or veterinary medicine. ($100)

> TIAN ZHOU
> Blacksburg High School

Dominion - W.W. Berry Award. This award is given by Dominion Virginia Power in honor of Mr. W. W. Berry who was a past Chairman of the Board of VA Power. This award of a $500.00 Savings Bond will be presented to the best engineering paper. The winners must see the Director by the stage after the awards ceremony.

> JOY E. LEE
> Thomas Jefferson High School for Science and Technology

The Joyce K. Peterson Award is presented for the outstanding paper by a middle school student. It is presented in honor of Mrs. Joyce K. Peterson who has been an outstanding teacher in the Arlington County Schools. ($50)

> CONAN ZHAO
> George H. Moody Middle School

The Ann M. Hancock Award - This award is given to the best paper in genetics and is given in memory of Anne Hancock who retired from Patrick Henry High School in Hanover County and who gave many years of service to the Jr. Academy not only by teaching but also serving on the Jr. Academy Committee. ($100)

> CAROLYN SONG
> Mills E. Godwin High School

Dorothy Knowlton Award - This award is given to the best paper in the Consumer Science section(s) and is given in honor of Dorothy Knowlton, former Science Coordinator of Arlington County Schools. ($50)

> BRITTANY COOK
> Southwest Virginia Governor's School

VABE Award - This award is presented by the Virginia Association of Biology Educators and is given for outstanding research in the Zoology section. ($100)

> ALEXANDER KIM
> Thomas Jefferson High School for Science and Technology

Virginia Museum of Natural History Award - Presented by the Friends of the Virginia Museum of Natural History in recognition of significant contribution in the study and interpretation of Virginia's Natural Heritage. The winner will receive $100.

> SETH THEUERKAUF
> Chesapeake Bay Governor's School

Trip to AJAS - AAAS Meeting for two students for presenting outstanding papers. The 2009 meeting will be held in Feb.in San Diego.

Winner BRANDEN T. KATONA
    Mills E. Godwin High School
Winner PRASANNA G. JOSHI
    Mills E. Godwin High School

Honorary Membership - AAAS given to two students.
    PRAKRITI VERMA
    Grafton High School
    TARA ADISHESAN
    Ramana Academy

Honorary Membership - VAS given to a student.
    ELIZABETH GENTRY
    Atlee High School

Bethel High School Scholarship - This $1,000 Scholarship Award comes from the interest earned from a $10,000 endowment contributed by the students of Bethel High School, Hampton, Va., over a two year period. This award is based on both the students presentation and paper.
    KATHERINE AGNEW
    Central Virginia Governor's School

Henry MacKenzie Environmental Scholarship - This $5,000 scholarship will be awarded to the student whose paper evidences the most significant contribution in the field of Environmental Science dealing with the James River Basin and Chesapeake Bay. The Virginia Endowment and VJAS offer this scholarship in tribute to the outstanding and generous services of Judge Henry W. MacKenzie, Jr., one of the founding directors who has a great interest in the James River and the Chesapeake Bay.
    SETH THEUERKAUF
    Chesapeake Bay Governor's School

Frances and Sydney Lewis Environmental Scholarship: A $14,000 scholarship ($3,500 per year for four years) for the best effort by a student in grades 9 to 12 in the field of environmental science. This scholarship is in the name of Frances and Sydney Lewis and is given by the Virginia Environmental Endowment.
    ALEXANDER KIM
    Thomas Jefferson High School for Science and Technology

E.C.L. Miller Science Teacher of the Year Award is given to an outstanding science teacher. An all-expense-paid trip to the next VAST meeting held in November.
    MARIVIC MITCHELL
    George H. Moody Middle School

VJAS Distinguished Service Award, most prestigious award given by the VJAS, is presented to a person for exceptionally outstanding service to the VJAS.
PAM GENTRY

2009-2010 VJAS Officers

Historian - VANESSA GENTRY
ALAN BOOTH
Secretary - ANA O'HARROW
Vice President - WILL NOSTRA
President - SUCHANA COSTA

NEW FELLOWS

M. Leroy Spearman

M. Leroy Spearman, a research scientist at the National Aeronautics and Space Administration Langley Research Center, has contributed to the advancement of scientific research and science education in Virginia and in his discipline throughout his career. Through his research on airfoils, surface flow, and materials and his management of wind tunnel facility projects, he has become a national leader. He has mentored countless graduate students and managed their projects. For several decades. he has enthusiastically and tirelessly served the Academy as Chair and Program Chair of the Academy's Aeronautics and Aerospace Sciences Section.

Leroy Spearman retired from NACA/NASA December 31, 2004 after over 60 years of government service. He earned a B.S. degree in Aeronautical Engineering from Auburn University, 1943, and began his government service at Langley Field, VA in March 1944. At the time of retirement he was an aerospace technologist in the Systems Analysis Branch, Aerospace Systems, Concepts & Analysis Competency at the NASA-Langley Research Center, Hampton, VA where he was involved in assessing advanced vehicles including civil transports, hypersonic vehicles, various types of missiles and new innovations. He is recognized as an authority in the fields of aerodynamics, stability and control, and performance of aircraft, spacecraft and missiles. Leroy has conducted wind tunnel research investigations throughout the subsonic, transonic and supersonic speed ranges.

Leroy began his career in 1944 with NACA at what was then the Langley Memorial Aeronautical Laboratory. He was assigned to the Atmospheric Wind Tunnel where he made some of the first tests of swept wings in the US.

He was transferred to the new 7 x 10-foot tunnels in 1946 where he continued his study of swept wings. He conducted some of the earliest transonic tests in the US using the transonic-bump technique. These tests revealed, for the first time, some of the

aerodynamic phenomena to be encountered in flight at supersonic speeds. These tests included a model of what was to become the first airplane to exceed the speed of sound, the Bell X-1.

In 1948, he was transferred to the new 4 x 4-foot supersonic pressure tunnel where he extended his aerodynamic studies to supersonic speeds. There he was responsible for stability and control studies that had an impact on essentially every supersonic aircraft and missile built in the US. He made the first supersonic tests of the variable sweep wing concept, canard airplane and missile configurations, and some of the earliest tests of supersonic transport concepts.

In 1963, he began to conduct research studies including wind-tunnel tests that were designed to assess the status of foreign technology. Over the years these studies have had a significant effect on the direction taken by some US programs.

In 1974, Spearman was assigned to the High-Speed Research Division Office as Chief Scientist for Military and Foreign Technology. He was reassigned in 1979 to the Aeronautical Systems Division as a Senior Technical Specialist where he participated in the development and assessment of a variety of advanced vehicles.

In addition to his significant contributions to research. Mr. Spearman has participated as a mentor in the New Horizons Regional Education Center program for talented-and-gifted high-school students and in the NASA Langley Virginia Governor's School Program. For several years he has instructed, guided, and encouraged those students who are looking toward a career in engineering. He also promoted interest in math and science as a guest teacher in local schools.

Leroy is a Fellow of the American Institute of Aeronautics and Astronautics. He is a member of the Air Force Association, the Auburn University Alumni Engineering Council and the Virginia Academy of Science. He has been honored by all of these groups and has received a number of NASA awards as well.

Leroy Spearman is credited with authoring over 316 technical publications. He continues to work with NASA as an unpaid Distinguished Research Associate, and continues to author papers for technical societies.

Donald Allen Whitney

Dr. Donald Whitney, a physicist and Dean of the Graduate School at Hampton University, has contributed to the advancement of scientific research, science education, and research and education management in Virginia and in his disciplines throughout his career. For several years he has enthusiastically and tirelessly served the Academy as President and member of Council and as Chair of Local Arrangements for several Academy annual meetings at Hampton University.

Don, Dean of the Graduate College and Associate Professor of Physics at Hampton University. served as 84th President of the Virginia Academy of Science (2006-07). A long time member of the Academy's Astronomy, Mathematics and Physics Section, he has served as the Section's Chair, Secretary and several terms as Editor. His Academy offices include President-Elect. Vice President, Secretary, and Treasurer. Don chaired the Local Arrangements Committees for 80th and 86 Annual Meetings (2000-02 and 2006-08), was Program Chair for the 83rd Annual Meeting at James Madison University (2005), and currently serves on the Finance and Nominations committees.

Don's first of several presentations to the Academy was a paper on solar energy measurements in 1982. Characteristic of much of his career as a science educator, many other papers would be co-authored with student co-investigators. As a scientist and research and academic administrator, Hampton University graduate and undergraduate students would also benefit from $2 million in grants, for which Dr. Whitney was Principal Investigator or Project Director, from the National Science Foundation, Sherman Fairchild Foundation, U.S. Department of Education, National Aeronautic and Space Administration, and Battelle Pacific Northwest Laboratory.

Don's dedication to science education extends as well to middle and secondary students and their teachers through workshops, lectures, and demonstrations for city and county schools and judging science fairs and local science fair projects. For over twenty years, Don has served as a Judge for the Annual Meetings of the Virginia Junior Academy of Science.

Dr. Whitney's research interests are in laser physics, environmental and atmospheric sciences, and low temperature solid state physics. His studies have been published in *American Institute of Physics Proceedings, Bulletin of the American Physical Society, Progress in Solar Energy, Solid State Communications,* and *Physical Review.*

At Hampton University, he has served on more than fifty governance committees, often as chair. Hampton recognized Don's leadership early, naming him the university's first Assistant, and then Associate, Dean. As a consultant, he has contributed to physics education and curriculum design for the U.S. Air Force Academy, University of Dallas, NASA-Langley Research Center, National Science Technology Society. U.S. Department of Education, and as a reviewer for several textbook publishers. For several years he has worked on physics education standards of the MCAT and NTE for the Educational Testing Service.

Donald Allen Whitney holds a B.S. in Physics from the University of Scranton (1969) and the Ph.D. in Physics from the University of Virginia (1977). He was an NDFA Fellow, Eli Lilly Post-Doctoral Fellow, and an American Society for Engineeriniz Research Fellow. A member of Sigma Xi National Honor Society, Dr. Whitney has been listed in Who *Who in the South and Southwest* and Who s' *Who Among Americas' leachers.*

Susan P. Booth

Susan Booth has contributed to the advancement of science education in Virginia as a teacher and teacher educator throughout her career. For several years she has enthusiastically and tirelessly served the Academy through its Virginia Junior Academy of Science Committee, as Director of the Virginia Junior Academy of Science, and by her work with the American Junior Academy of Science and similar organizations.

Susan P. Booth has been Director of the Virginia Junior Academy of Science since 1999 and Executive Director of the Virginia Association of Science Teachers since 2000. Susan has taught at Kecoughtan High School since 1986, where she was named "Biology Teacher of the Year" and "Teacher of the Year," and at Lee-Davis High School (1984-86) and .I.E.J. Moore High School (1983-84). From 1991-97, she was the Newport News School System's Science Specialist, K-12.

Susan's enduring interest in VJAS includes decades of service on the VAS Junior Academy Committee and later as VJAS Assistant Director. In 1991 she was honored with VMS Science Club Sponsor Award. The breadth and depth of her many contributions to science education has also been recognized in the Outstanding Volunteer Award of the Virginia Association of Science Teachers (1992), the Distinguished Service Award of the Tidewater Science Congress (1994), and the Equity Award of the National Association of Biology Teachers (1996).

A consultant for International Science and Engineering Fairs, Susan Booth has presented papers and conducted teacher workshops for the Tidewater Science Congress, V-Quest (Virginia Department of Education), the Virginia Association of Science Teachers. and NASA Langley Research Center. She has published articles in the *Journal of Virginia Science Education* and *The Daily Press* and has been awarded grants from the Virginia Department of Education, the Virginia Commission for the Arts, and the American Association for the Advancement of Science.

Currently, Susan also serves on the Tidewater Science Congress Advisory Board and the Board of Directors of the Virginia Association for Supervision and Curriculum

Development. She has been a National USA/USSR Educator (1990) and a NASA Project Stars/V-Quest Initiative Teacher/Researcher (1994). In service to her community she was Hampton's Clean City Coordinator and School Pride in Action Coordinator; Susan was honored by the City of Hampton with its Outstanding Volunteer Award (1993).

Susan majored in Biology-General Science at Mary Washington College (B.S., 1983) and earned her M.A. in K-12 Supervision (1992) and Ed.S. in K-12 Administration (1993) from George Washington University. Her Virginia certifications include General Science and Biology, Elementary School Principal, Middle School Principal, and High School Principal.

A member of Phi Delta Kappa National Honor Society, Susan is also a member of the Mathematics/Science Coaltion-Region 2, the Virginia Science Resource Network, the National Association of Biology Teachers, and she is a an Academic Reviewer for the Virginia Department of Education. Susan Booth has been also been named to several editions of *Who Who Among Americas' Teachers.*

AUTHOR INDEX

NOTES

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