A DESIGN CONCEPT FOR ALLEVIATING SOME SIZE CONSTRAINS FOR LARGE AIRCRAFT. M. Leroy Spearman, NASA-Langley Research Center, Hampton, VA 23681. The basic wing-body-tail arrangement of conventional transport aircraft generally consists of a central fuselage with forward-mounted wing panels attached to each side, and with aft-mounted tail surfaces. This arrangement has remained essentially unchanged over the years, and increased capacity has been achieved simply by increasing the overall size of the aircraft. However, such an approach may be limited for aircraft beyond the size of the current jumbo jets such as the Boeing 747. For very large aircraft, a serious problem may occur from the trailing vortex flow that would be generated at the wing tips under lifting conditions. The tip vortex presents a hazard to trailing aircraft that may be upset if they fly into the path of the vortex. Such a vortex would be much stronger than that for current transports because of the increased lift required for the larger aircraft. In an effort to alleviate such a problem, some research has been conducted with an unconventional design for a large aircraft. The design consists of a large rectangular wing surface with large bodies attached to each wing tip. There are no outboard, wing panels such as those used on conventional aircraft designs. The use of two bodies of a conventional aircraft design results in doubling the capacity of the conventional aircraft. The large area of the rectangular wing provides adequate lift to sustain flight. The tip-mounted bodies act as end plates for the wing and the formation of a trailing vortex is precluded. Wind tunnel tests have been made of such a concept using two simulated Boeing-747 fuselages. Compared to a basic B-747, the resulting concept provides a payload capacity twice that of a B-747 with no increase in length, a decrease in span, and no trailing tip vortex.

SOME EVENTS FROM THE FIRST CENTURY 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.

**Agriculture, Forestry and Aquaculture Science**

**THE EFFECT OF LARGEMOUTH BASS PREDATORS ON GROWTH AND FEEDING IN CHANNEL CATFISH.** Michael L. Fine & Mark S. Mayo Dept. of Biol., VCU, Richmond, VA 23284-2012 and Edward N. Sismour & Scott H. Newton, VSU Agricultural Research Station, Petersburg, Virginia 23806. We examined the effects of largemouth bass predators on growth and feeding in channel catfish. Eight 75 gal tanks were divided in half with a plastic mesh, and 10 catfish were placed on the right side of each tank. The left sides were empty in four tanks (controls) or contained a largemouth bass predator (experimentals) in the other four. Bass were typically fed a channel catfish twice a week, and the experiment ran for 3 months. We measured catfish total length, weight and condition factor (W/L³) to determine growth and recorded the number of pellets eaten, the time to eat 10 pellets, and catfish movement using a nonparametric scale from 0 to 3. Catfish grew significantly in both treatments, but weight and condition factor were higher in control fish than in experimentals. Control fish also ate twice as many pellets per minute and consumed more pellets than experimentals. Finally, control fish exhibited continuous movement, but experimentals typically remained stationary with low amplitude tail fluttering and opercular movements. When bass were fed a catfish, movement further decreased. Opercular movement stopped for about 15 sec after a latency of 24 sec, suggesting a chemical cue from catfish predation. Therefore, proximity of largemouth bass suppresses growth, feeding rate, amount of food consumed, and movement of channel catfish. Not only can bass predators affect survival of recently stocked catfish, they can retard the time it takes them to grow to a nonsusceptible size.

**USING CYTOCHROME B TO DETERMINE SPECIES IN MIXED MEAT SAMPLES.** Altamarie Woods & Brian L. Sayre, Dept. of Biology, Virginia State
University, Petersburg, VA 23806. Growth in world trade of animals, animal parts, food products for consumption and manufacturing intensifies the demand for product certification to warrant public and animal health safety standards. For example, ground meat labels that state the product is 100% of a species must be the only the species labeled. Current methods were unable to identify more than one species by using a single assay. The objective was to determine the feasibility of using microarray technology to identify species from mixed DNA samples. Mitochondrial DNA collected from samples of beef tips, chicken breast, and pork chops was amplified with primers for the cytochrome b gene (638 bp). This product was denatured, spotted onto nylon membranes, and cross-linked to the membrane. The target DNA was amplified in individual and mixed species samples with PCR using primers that produced a 95-bp product and was nested within the cytochrome b 638-bp product. The target DNA was hybridized for 3 hours to the microarray membrane. After hybridization the membrane was washed, developed, and imaged. The optimal hybridization temperature for the individual and mixed samples was 62°C and 60.5°C, respectively. The individual species samples were confirmed with hybridization of the target to a single probe on the array. Using the array, the identity of the species within the mixed species samples could be determined; however there were some false positives. This data indicated that the probes need further optimization to be conclusive. Based on the results of this project, one can conclude that microarray technology can be an effective tool for species identification, but will require more optimization.

THE RELATIONSHIP OF SWIMBLADDER STRUCTURE AND MATERIAL PROPERTIES TO ACOUSTIC FUNCTION IN SOME STEM TELEOSTS. Lettie C. Lawrence & Michael L. Fine, Dept. of Biol., Virginia Commonwealth Univ., Richmond VA 23284-2012. The teleost swimbladder functions in respiration and buoyancy and has evolved adaptations for hearing and sound production. Alosid herrings are extreme auditory specialists that can hear ultrasounds, aided by connections from the swimbladder to the ear. However, similar connections occur in nonalosid herrings without this ability. We describe the structure and material properties of two alosids, the American shad *Alosa sapidissima* and the blueback *Alosa aestivalis*, that hear sonic (0.2 kHz) to ultrasonic frequencies (180 kHz). We examined the gizzard shad *Dorosoma cepedianum* as an out-group in the clupeid family that cannot hear ultrasounds and the rainbow trout *Oncorhynchus mykiss*, an auditory generalist without auditory connections. All these species have transparent to translucent swimbladders. Picro-Ponceau and Weigert Iron Hematoxylin, and Verhoeff Elastin stains indicate swimbladders are composed of collagen but not elastin. Circular fibers have a greater thickness throughout the swimbladder in *A. sapidissima* and *A. aestivalis*, but *D. cepedianum* and *O. mykiss* have few circular fibers but well-developed longitudinal fibers in the tunica externa. *O. mykiss* swimbladders have a higher toughness and Young’s Modulus and are stronger than in clupeids. The circular fibers of the alosids exhibit the greatest strain at break and could aid auditory function and allow for swimbladder expansion under greater pressure in deep water.
SCALING OF PECTORAL MUSCLES OF VIRGINIA CATFISHES. Joseph P. Miano & Michael L. Fine, Dept. of Biol., Virginia Commonwealth Univ., Richmond, VA 23284-2012. The muscles of the pectoral spine in ictalurid catfishes are the spine abductor, the arrector dorsalis, the arrector ventralis, and the spine adductor. We examined the scaling of these muscles as a function of both body weight and percent body weight in *Ictalurus furcatus* (blue catfish), *Ameiurus catus* (white catfish), and *Pylodictis olivaris* (flathead catfish). Percent muscle weight in blue catfish increased non-linearly, with larger fish having proportionately smaller muscles, for all muscles but the arrector ventralis, which maintained linear growth. In flathead catfish only the spine adductor grew non-linearly, and all muscles in white catfish exhibited linear growth. Both the spine abductor and spine adductor were larger than the arrector dorsalis and arrector ventralis in all species. The spine abductor and spine adductor are responsible for large amplitude movements, and the arrector dorsalis and arrector ventralis have more specialized functions in spine elevation. The percent size of the spine abductor, spine adductor, and arrector dorsalis is similar in blue and white catfish. Abductor and adductor muscles were larger in blue catfish than in flathead catfish, but the arrector dorsalis and arrector ventralis were similar. All white catfish muscles, except for the arrector ventralis, were proportionately larger than in flathead catfish muscles.

OVER-WINTER CAGE CULTURE OF BROWN TROUT (*Salmo trutta*). Scott H. Newton and Edward N. Sismour, Virginia State University Agriculture Research Station, Petersburg, Virginia 23806. Three cages of brown trout (*Salmo trutta*) were reared alongside three cages of rainbow trout in a comparison trial during from fall 2007 to spring 2008. This was the second research attempt to cage rear brown trout in Virginia. During the first attempt (early 1990s), brown trout failed to survive in cages in a Nottoway County farm pond when water temperature began to fluctuate during April. In the present study, brown trout survival was high (> 98%) in two cages but very poor (73%) in a third cage due to irregular feeding activity that led to cannibalism. Overall, brown trout survival was only 75% compared with 98% for rainbow trout. Brown trout growth was less than rainbows with harvest weights averaging two ounces less than rainbow trout. Brown trout production is risky due to the predaceous and cannibalistic nature of this species. Also, another natural factor is their growth phase begins at a larger size than is normally considered compatible with caged fish culture. Unless there is a very specific marketing reason, brown trout is not a good commercial cage culture candidate.

FISH HEALTH PROBLEMS FROM CAGE-READED CATFISH FINGERLINGS FOLLOWING TRANSPORT David Crosby1 and Edward N. Sismour2 1Virginia Cooperative Extension, Virginia State University, PO Box 9081, Petersburg, VA 23806; 2Agriculture Research Station, PO Box 9061, Virginia State University, VA 23806. Transport of catfish purchased from out-of-state producers can require in excess of 20 hours causing stress on fingerlings. This study examined short-term (3-week) survival of catfish following transport and stocking into cages. Fish were
delivered in June and September, 2007. Sixty fish were randomly sampled at initial stocking (Week 0) and at weekly intervals for three weeks post-stocking to assess the prevalence of parasites of the skin and gills. Catfish were free of clinical signs of diseases at the initial stockings, while gills of several of the June catfish (5%) indicated that Proliferative Gill Disease had been present. In June, fish started to die from external Columnaris within two days of the initial stocking and ESC was also recovered from these fish. Gill worms (Ligictaluridus) and Henneguya cysts were observed at Week 0 and Ichthyophthirius multifiliis (Ich) was present at Week 2 for both groups. Ich was observed among 18% of June fish and among 83% of September fish. Ich was no longer observed by Week 3 of the June study but was still present by the end of the September study. Total mortality was approximately 50% for the June group, whereas there was no significant mortality for the September group. It appears that the spring fingerlings were subject to more environmental and handling stress compared to the fall fingerlings.

LOW SALINITY PRODUCTION OF COBIA RACHYCENTRON CANADUM.
Brendan C. Delbos, D Russell, MH Schwarz, SR Craig, & E Mclean, VSAREC, Hampton, VA 23669. With the anticipated growth of domestic cobia aquaculture, alternative production techniques are being explored to facilitate the farming of this species in an environmentally and economically sustainable manner. The Virginia Tech Aquaculture Research Group in collaboration with MariCal, an animal health and nutrition company, have been examining the feasibility of culturing cobia in recirculating aquaculture systems under low salinity conditions. Implementation of this technology would allow the siting of production facilities away from delicate coastal ecosystems to inland areas. In addition, inland low salinity production effluent would be amenable to traditional municipal waste water treatment. During 2005 and 2006 two trials were conducted evaluating the effects of various ion ratios in water and diets on production of juvenile cobia under low salinity conditions. For trial I, a total of 240 fish (mean weight of 25.5g) were randomly assigned to one of two salinity treatments (20ppt and seawater diluted to 3ppt). Six iso-caloric diets with various ion additions were then randomly assigned to the low salinity treatment while a single control diet was fed to fish in the higher salinity treatment. For trial II, 240 test fish (mean weight of 41.9 g) were randomly assigned to one of three salinity treatments (equivalent to 1.8, 2.5 and 20ppt using proprietary salt blends) and one of four dietary treatments and acclimated to testing conditions over a two week period. Results from both trials indicate that although growth and feed efficiency were significantly reduced, cobia can be cultured as low as 2.5ppt without a significant decrease in survival. Furthermore, no significant differences among dietary treatments were identified at the lower salinities.

POND PREPARATION FOR STOCKING THE FRESHWATER SHRIMP (MACROBRACHIUM ROSENBERGII).
Brian L. Nerrie. Virginia Cooperative Extension, Virginia State Univ., Petersburg, VA 23806. Alternative crops are being examined in the tobacco growing region of Virginia. One such crop is the tropical
freshwater shrimp, *Macrobrachium rosenbergii*. Juvenile shrimp (0.5 g) are stocked in prepared ponds in late May when water temperature exceeds 20°C at a density of 20,000-50,000/ha. Natural pond foods and supplemental feed provides the nutrients for excellent growth. Decreasing water temperature dictates harvest in late September or early October of 30-45 g shrimp (800-1200 kg/ha). Appropriate pond preparation before stocking is essential for production success. Water quality management, soil conditioning, and sufficient fertilization to stimulate natural foods are required for success. Pond soil is limed to increase water alkalinity >50 ppm. Screened inflowing water limits the introduction of predators. Organic fertilizers such as alfalfa meal or pellets are applied two weeks before stocking at a rate of 250 kg/ha to establish zooplankton, aquatic worms and insect larva. High phosphorus inorganic fertilization encourages phytoplankton which is consumed by zooplankton.

**SURVIVAL AND GROWTH COMPARISONS OF SPRING-VERSUS FALL-STOCKED CATFISH FINGERLINGS IN CAGES OVER WINTER.** Edward N. Sismour & Scott H. Newton, Virginia State University Agricultural Research Station, Petersburg, Virginia 23806. Channel catfish (*Ictalurus punctatus*), an important fishery resource in Virginia, are regularly imported from southern states because of high demand. Fingerling purchases in the fall may be a better option for some producers. This study evaluated growth and survival of catfish fingerlings in cages over winter. The hypothesis that smaller, fall-stocked fish would exhibit reduced growth and survival compared to larger, spring-stocked fish was not supported. Two groups of catfish, one purchased and stocked in cages in mid-June, 2007 and the other in mid-September, 2007 were compared. Fish from each group were restocked into cages in mid-October, 2007. For each group, three cages were stocked with 215 fingerlings that were weighed (gm) and measured for total length (cm) at both stocking and harvest. Fish were fed a standard ration when winter pond water temperature exceeded 10 °C. Both groups had high survival, only four spring catfish died. Increase in length was not significantly statistically for spring catfish and was marginally significant for fall catfish. Weight increase in both groups was significant statistically and was greater proportionally for fall catfish. Feeding efficiency did not differ statistically. The practical significance of this study is that farmers could purchase fingerlings in the fall as water temperature decreases, possibly at lower cost and with minimal cost for feed to hold the fish over winter. This strategy would contribute to reduction of stress associated with transport and stocking in the spring and would help maximize production because fish would be in cages at the onset of the growing season.

**WATER QUALITY FROM MULTI-BATCHING CATFISH PRODUCTION PONDS IN VIRGINIA.** David Crosby. Cooperative Extension VSU, PO Box 9081, Petersburg, VA 23806. Multi-batching catfish production project was initiated to simulate seine through water shed ponds in June of 2005. Five ¼ acre ponds were stocked with catfish weighting 55 lbs. /1000 fish. Catfish were stocked at 5000 fish
per acre. Fish were fed to satiation from Monday through Friday. One of the project objectives was to monitor and collect water quality data from June to September. The average daily feeding of catfish ranged from 40 lbs to 60 lbs of feed per day during this part of the study. Water samples were collected from 2005 to 2007 for each pond once-a-week in the afternoon before 3 pm. Water quality parameters tested included pH, TAN, and Nitrite. All parameter levels were typical for this type of catfish production system. The hardness and alkalinity ranged from 34 to 51 ppm. The pH ranged from 6.0 to 10.0 for all ponds. TAN were below 2.5 ppm for the entire study. Nitrites were consistently below 0.25 ppm. However, some ponds did spike to nearly 1 ppm. Ponds with nitrite spikes were treated with salt. The overall water quality (TAN and Nitrite) for the first three years was considered very acceptable for this type of catfish production system.

CHANGING PATTERNS OF ANTHELMINTIC USAGE AND RESISTANCE IN VA SMALL RUMINANT INDUSTRIES. Joseph P Tritschler, Michaela PL Dismann, & Brian L Sayre, VA Coop Ext, VSU, Vet Sci, Chesterfield Tech Center, & Dept Biol, VSU. By combining producer data, on-farm Fecal Egg Count Reduction tests and in vitro larval development assays, a detailed status of anthelmintic resistance on 20 representative Virginia small ruminant farms was generated. Data covered 2002-08. Modern anthelmintics represent only three pharmacological classes: benzimidazoles (BZ), levamisole/morantel (LM) and macrocyclic lactones (ML). In general, once resistance develops to any drug in the class, cross-resistance will rapidly be expressed to the complete class. Several critical trends were noted. BZ resistance approached 100% of farms. For LM class, morantel was resistant on 67-95% and the more effective levamisole showed 40-75% failure. For ML class, ivermectin (IVE) resistance approached 100% of farms, and the newer moxidectin (MOX) showed 40-70% failure. MOX demonstrated a dramatic time effect, showing only marginal signs of resistance in 2002-03 data and almost complete failure in limited 2007-08 data. It is estimated that 33-50% of Virginia farms no longer have any effective anthelmintic, BZ and IVE are resistant on over 90% of farms, 20-25% have one effective anthelmintic (LEV or MOX) and less than 10% have both LEV and MOX still effective. Future strategies relying heavily on anthelmintics will fail. The authors gratefully acknowledge the help of the Veterinary Science program at Chesterfield Technical Center.

OILSEED FLAX AND HUMAN HEALTH Harbans L. Bhardwaj and Anwar A. Hamama, Agricultural Research Station, Virginia State University, Petersburg, VA 23806. Oilseed flax (Linum usitatissimum L., Family Linaceae) has gained recognition as a functional food i.e. it provides health benefits beyond what is expected from its traditional nutritional content. Oilseed flax oil is a rich source of α-linolenic acid (also known as Alpha Linolenic Acid; 18:3n-3; Omega-3 fatty acid). Higher 18:3 content is desirable for human nutrition. Canada is the largest producer and exporter of flax in the world. Efforts are on-going at Virginia State
University to evaluate potential of oilseed flax, as an alternative crop. We studied the oil content and quality of seed from five oilseed flax cultivars grown at Petersburg and Suffolk during 2003-04 crop season. Flax seed contained 42.3 percent oil which contained 47.8 and 18.9 percent linolenic and linoleic fatty acids, respectively. The ratio of Omega-3 to Omega-6 fatty acids in flax oil was 2.5 indicating that flax oil is healthy for human consumption. It was concluded that flax have potential as new crops in Virginia to provide healthy oils for human consumption. On-going field research includes experiments at three Virginia locations (Orange, Petersburg, and Suffolk) to determine optimal planting time, productivity, and oil traits. Faculty and staff volunteers from Virginia State University are participating in a study to determine effects of consuming 30 g ground whole flaxseed daily for 12 weeks on blood traits.

PHOTOSYNTHETIC RESPONSE OF GREENHOUSE TOMATOES TO DIFFERENT TEMPERATURES AND CO$_2$ CONCENTRATIONS UNDER LOW WINTER LIGHT CONDITIONS. Mark Kraemer & Françoise Favi, Agricultural Research Station, Virginia State University, Petersburg, VA 23806. Winter production of greenhouse tomatoes in the mid-Atlantic region is constrained by low light intensity. Periods of cloudy weather in late winter and spring, when tomato plants are in full production, have often led to stress induced problems such as blossom drop and susceptibility to disease. To reduce these problems we used a portable photosynthetic meter (Licor 6400) to determine the photosynthetic rate of leaves in a producing greenhouse, at different temperatures, light intensities, and CO$_2$ concentrations. Higher temperatures resulted in higher photosynthetic rates when light intensities were above 100 PAR, but reduced photosynthetic rates when lower. High CO$_2$ concentrations (1200 ppm) resulted in greater photosynthesis (40-60%) at all temperatures up to 89 °F. These results indicate that temperatures in tomato greenhouses should be reduced during periods of low light intensity to below 65 °F and CO$_2$ should be enhanced if possible.

COMPARISON OF THREE TYPES OF SOILESS MEDIA FOR PRODUCTION OF GREENHOUSE TOMATOES IN VIRGINIA. Christopher D. Mullins, Cooperative Extension, Virginia State Univ., Petersburg VA. 23806. While rockwool is the primary root substrate used in greenhouse tomato production, most small growers in Virginia prefer using peat-based media in vertical five gallon bags. However, growing concerns about the non-renewable nature of sphagnum peat moss and rising prices of peat-based media has growers looking for other types of media for tomato production. A two year study of effect of media type on yield of greenhouse tomatoes was started in fall 2006. Peat-based media, coconut coir, and perlite were compared as root substrates for production of greenhouse tomatoes. Tomato cultivar 'Trust' was grown in all three media types in plots of three plants with each media treatment replicated seven times. Irrigation and fertigation were the same for all plants. No significant difference was found in marketable yield or
fruit size in year 1. Any of these substrates would be suitable for tomato production. Cost, availability, ease of use, and other benefits should be considered driving factor in grower’s decision concerning media type.

ALLELOPATHIC REACTIONS GENERATED BY *VERNONIA GALAMENSIS* (VGA) AERIAL PART. Francoise D. Favi & Mark Kraemer. Agricultural Research Service, Virginia State University Petersburg VA 23806. VGA pappus transports mature achene as parachutes by wind into new territory and contain both sesquiterpenes and triterpenes. We use bioassays and light microscope to assess allelopathic effects of these chemicals on soybean seedlings. Pappus chemicals significantly (DF = 3, F = 74.20 and P> 0.0001) prevent damping-off diseases of both VGA and soybean seedlings at first stage of germination. Ten-day old soybean seedlings were significantly rotten (DF = 3, F = 6.53 and P> 0.0152) or bent due to weaken stem. Light microscope of thick sections of the treated seedling stem showed disorganized parenchyma cells compared to the control.

**Astronomy, Mathematics and Physics and Materials Science**

**FACTORING SECOND DEGREE POLYNOMIALS OVER THE INTEGERS: MOTIVATING SECONDARY SCHOOL TEACHERS TO LEARN PROOF TECHNIQUES.** Sherrie N. Mitchell & Boyd Coan, Dept. of Mathematics, Norfolk State Univ., Norfolk, VA 23504. Traditionally, secondary school instructors are taught many different techniques for making elementary algebra and arithmetic more palatable to the layman meeting these mathematical ideas for the first time. However, it is rare if ever, that the opportunity is available to illustrate the duality between research and teaching. To do research and develop original techniques and methods in mathematics, it is helpful to learn how to construct, write and read mathematical proofs. This in turn leads to improved teaching. Presenting mathematical proof techniques to the layman in an effective algorithmic manner remains elusive. Polya’s four-step problem solving process provides a novel approach to the efforts to make it more a science than an art, to motivate secondary school teachers to learn proof techniques. Factoring second-degree polynomials over the integers is used as an example of a proof based project.

**PROPOSED METHOD FOR PLASMA-TREATED NANOCOMPOSITE THIN FILMS AS A METAL ADHESION LAYER FOR POLYMER SUBSTRATES.**

1Bruno J. Caputo, 2Ethan Rosenthal, 1Christopher Hughes & 2Brian Augustine.

1Dept. of Physics and Astron., and 2Dept. of Chemistry, James Madison Univ., Harrisonburg, VA 22801. This project is focused on chemically adhering a metal to a polymer substrate. Using Polymethyl Methacrylate (PMMA) slides, the nanocomposite polymer poly[(propylmethacryl-heptaisobutyl] polyhedral oligomeric
silsequioxane)-co-(methylmethacrylate)] (POSS-PMMA) can be spuncoat onto the PMMA slide and then plasma etched. A glass-like layer forms on the surface opening up the POSS cages allowing for better adhesion for gold films and better protection of the PMMA during chemical processes. The process uses an electron beam deposition method and adhesion tests are to be conducted using chemicals such as Methyl Methacrylate, hexane, tetrahydrofuran (THF), isopropyl alcohol, and water. Afterwards, the adhesive properties will be measured using an Atomic Force Microscope (AFM) and a Scanning Electron Microscope (SEM).

GENERATION OF ASYMPTOTICALLY CONVERGENT APPROXIMATIONS FROM DIVERGENT PARKER SOCHACKI EXPANSIONS. Joseph D. Rudmin, Integrated Science and Technology Dept., James Madison Univ., Harrisonburg VA 22807. Several years ago Drs. Ed Parker and James Sochacki published a remarkably efficient general algorithm to generate the Taylor series solution to any system of differential equations. When this Taylor series is divergent, one would like to generate a convergent representation. Presented here is a general algorithm to convert any divergent Taylor series to a ratio of two asymptotically convergent polynomials. This algorithm is an extension of a simple and general algorithm to obtain a ratio of two integers, which approximates an irrational number, and uses the minimum number of digits in the ratio for a specified precision.

INFRARED SPECTROSCOPY OF HOLMIUM DOPED KPb₂Cl₅ FOR LASER APPLICATIONS. O. Oyebola¹, E. Brown¹, U. Hommerich¹ & S. Trivedi², ¹Dept. of Physics, Hampton Univ., VA 23668 and ²Brimrose Corporation of America, Baltimore, MD 21236. The optical properties of rare earth doped potassium lead chloride (KPb₂Cl₅) continue to be of current interest for applications in infrared (IR) solid-state gain media. In contrast to many other halides, KPb₂Cl₅ is non-hygroscopic, which makes it an attractive host material for solid-state lasers. The narrow phonon spectrum of KPb₂Cl₅ extends to only ~200 cm⁻¹, which leads to small non-radiative decay rates through multi-phonon processes. In this work, we present the infrared emission properties of Ho³⁺ doped KPb₂Cl₅ and evaluate its potential as a novel IR gain medium. Following optical excitation at 885 nm, several IR emission bands were observed with center wavelengths at 1063 nm, 1172 nm, 1333 nm, 1655 nm, 2886 nm and 3900 nm. Further spectroscopic studies were focused on the mid-IR emission at 3900 nm arising from the Ho³⁺ transition ⁵I₇→⁵I₄. The emission lifetime of the ⁵I₇ level was measured to be 4.9 ms at room-temperature and remained nearly constant when cooling the sample to 15 K. The nearly temperature independent lifetime is consistent with a small non-radiative decay rate for the ⁵I₄ excited state of Ho³⁺ as predicted by the energy-gap law.
NEAR INFRARED EMISSION PROPERTIES OF Er:YAG CERAMIC, Er K Pb₂Cl₅, AND Er:K Pb₂BR₅ FOR 1.5-1.6 μm EYE-SAFE SOLID STATE LASERS. C. Hanley⁴, E. Brown⁴, U. Hömmerich⁴, S. Trivedi⁴,¹ Dept. of Physics, Hampton Univ., Hampton VA 23668 and ²Brimrose Corporation of America, Baltimore MD 21236. There exist a significant current interest in the development of a new generation of long-wavelength eye-safe bulk solid-state lasers with resonance diode laser pumping. Applications of laser sources that operate in the eye-safe wavelength regime near 1.5-1.6 μm include remote sensing, ranging and material processing, long distance telemetry, and optical communications. Eye-safe laser wavelengths can be achieved by using trivalent Er³⁺, a rare earth ion that has an emission transition at ~1.5 μm Er³⁺. Trivalent erbium Er³⁺ (4f¹) has been considered an important activator ion in many infrared solid-state lasers. For eye-safe laser operation Er:YAG continues to be the main material under consideration. In this investigation other materials were evaluated as potential gain media for the 1.5 μm spectral region including ceramic Er:YAG, Er K Pb₂Cl₅, and Er:K Pb₂BR₅. Results of a comparative spectroscopic study of these materials will be presented at the conference including infrared absorption and emission studies, lifetime measurements and calculation of 1.5 μm transition cross section.

PRELIMINARY STUDIES OF A PLANAR TRANSFORMER. Gregory A. Topasna & Daniela M. Topasna, Dept. of Physics and Astronomy, Virginia Military Institute, Lexington VA 24450. We present the preliminary results of a planar transformer consisting of a straight wire that is flux linked to a rectangular loop. Our calculations indicate a linear relationship between the input and output voltages that is frequency dependent. Electrical characterization of this transformer also shows linear voltage dependence that is consistent with our calculations at low frequencies.

NUMERICAL SIMULATION OF FIBER SEDIMENTATION IN NAVIER-STOKES FLOWS. J. Wang, Dept. of Mathematics and Statistics, Old Dominion Univ., Norfolk, VA 23529 & A. Layton, Dept. of Mathematics, Duke Univ., Durham, NC 27708. Many physical and biological applications involve the dynamics of a large number of fibers immersed in a viscous fluid. It is of significant importance to accurately predict the behavior of the fiber-fluid interactions. We perform a study on this problem by formulating a computational hydrodynamic model based on the Navier-Stokes equations, and making use of a numerical technique known as the immersed boundary method. We discuss the effects of fiber shapes, fluid viscosities and physical boundaries on the behavior of the fiber suspension and sedimentation.

POWER BASIC CONSOLE COMPILER—A POWERFUL COMPILER FOR PROGRAMMING TECHNICAL APPLICATIONS IN WINDOWS. Joseph W.
Rudmin, Dept. of Physics and Astron., James Madison Univ., Harrisonburg VA 22807. The Power Basic Console Compiler is a Basic Language compiler with a structure similar to the language C. It generates high-speed stand-alone executable programs which work in the 32-bit Microsoft Windows operating system. It requires structured programming, and works well with Microsoft Software. It permits object oriented programming, and has many advantages over other programming systems. This talk gives a history of technical programming languages and discusses the pros and cons of each language.

ASTRONOMICAL OBSERVATIONS WITH A THERMOMETER. Thomas C. Mosca III, Dept. of Mathematics, Rappahannock Community College, 52 Campus Drive, Warsaw, VA. 22572. Spring, summer, fall, and winter are formally defined as the intervals between the solar equinoxes and solstices. The dates and times of the seasonal endpoints are determined astronomically. A less formal determination can be made using temperature. Spring and fall are periods during which temperature changes rapidly, and almost linearly. Summer and winter are the periods in between, during which temperature changes less rapidly, peaks, and the direction of change reverses. Mean daily water temperatures from 1954 until 2001, measured at Gloucester Point, Va. are used to graphically illustrate the four seasons, and the equinoxes and solstices are approximately located. Water temperature data were provided by Virginia Institute of Marine Science, Gloucester Point, VA. 23062.

QUARKNET AT HAMPTON UNIV. Kenneth Cecire & Donald Whitney, Dept. of Physics, Hampton Univ., Hampton VA 23668. Hampton Univ. has been involved with QuarkNet (http://quarknet.fnal.gov) since 1999 as the home base of one of the five QuarkNet staff members in the U.S. and since 2000 as a QuarkNet center. QuarkNet is a national program, funded by DOE and NSF, to bring particle physics into high schools. Thus the Hampton Univ. QuarkNet center consists of Hampton Univ. physicists, staff, and a cadre of Virginia high school physics teachers. With the support of the Hampton Univ. Center for the study of the Origin and Structure of Matter, this group has been involved in various local, nationwide, and global projects: cosmic ray detectors and the QuarkNet cosmic ray e-Lab (http://quarknet.fnal.gov/grid), the international particle physics Masterclass, support for a Virtual QuarkNet Center online, a student blog dedicated to the Large Hadron Colider at CERN, a teacher-led series of physics workshops for elementary school teachers (http://cosm.hamptonu.edu/~kcecire/pie/pie.html) in collaboration with Jefferson Lab, and mutual support as a group of like-minded physics teachers. Many of these initiatives have an online home at and can be accessed through a wiki on the COSM server at http://cosm.hamptonu.edu/vlhc. A small-to-medium-sized Univ. can have a significant impact on science education through a combination of components like these; emphases on exciting science research, bringing teachers into scientific collaborations, and teachers helping teachers can be combined with
provision of online resources to not only affect the local community but also to have an extended global impact.

### Biology and Microbiology

**EXPLORATION OF PHYTOPLANKTON COMMUNITIES IN SOUTHEASTERN VIRGINIA FOR USE IN BIODIESEL PRODUCTION.** Todd A. Egerton¹, Nathan A. Bowman¹, Robert J. Johnson¹, Mathew R. Semcheski¹, Harold G. Marshall¹, Zhanfei Liu², Adair Johnson², Rachael Cooper² & Patrick Hatcher², ¹Dept. of Biological Sciences and ²Dept. of Chemistry and Biochemistry, Old Dominion University, Norfolk VA 23529. A survey of thirty-nine freshwater and estuarine habitats in Tidewater Virginia was conducted to examine the capability of local phytoplankton populations for biodiesel production. Over 120 algal taxa were identified during the study, including several genera that have been previously noted as having potential biodiesel applications. Cyanobacteria were the dominant phytoplankton group at the majority of stations, however these locations generally had lower levels of fatty acid methyl esters (FAME). Samples containing higher abundances of chlorophytes, diatoms, and dinoflagellates had the highest percentages of FAME. The results of this initial study indicate that this region supports diverse phytoplankton communities including those that are potential sources of fatty acids needed to produce biodiesel. This study is a component of the Virginia Coastal Energy Research Consortium.

**THE SUPERIOR PREDATORY HABITS OF ALLOSAURUS IN JURASSIC NORTH AMERICA,** Jamie Stearns & Robert K. Rose, Dept. of Biological Sciences, Old Dominion University, Norfolk, VA 23529. Although the Morrison Formation of Late Jurassic North America contains many genera of carnivorous dinosaurs, one genus, Allosaurus, accounts for almost three-quarters of all finds of these predators. Based on previous studies of predatory habits of this genus and others, it appears likely that Allosaurus dominated the ecosystem due to specialized hunting adaptations, including strong arms with a good grappling ability and a specialized bite for hunting giant herbivores. Paleoenvironmental evidence from sites in Wyoming supports this conclusion.

**A PHYLOGENY OF THE SNAPPERS (LUTJANIDAE; PERCOIDEI) INFERRED FROM CYTOCHROME B SEQUENCE DATA.** Matthew R. Semcheski & Kent E. Carpenter, Department of Biological Sciences, Old Dominion University, Norfolk, VA 23529. The Lutjanidae are the economically and ecologically important fishes commonly known as snappers. Early studies of Lutjanidae concluded that it contained four subfamilies. Together with the family Caesionidae, the lutjanids formed the Superfamily Lutjanoidea. Although this view was supported elsewhere
in the literature, it was later contradicted, treating the caesionids as members of the Lutjanidae. Further investigations revealed complications within the subfamily Lutjaninae. In order to infer a phylogeny of genera within Lutjanidae, the complete cytochrome b gene (1140bp) of 21 lutjanid taxa was sequenced and analyzed along with 19 sequences obtained from GenBank. Analyses included base composition, saturation analysis, maximum parsimony (MP), maximum likelihood (ML), and Bayesian inference (BI). Substitutions increased linearly with sequence divergence. MP analysis failed to resolve relationships at the subfamily level. ML and BI analyses resolved monophyletic Etelinae, Apsilinae, and Paradicichthyinae subfamilies within Lutjanidae. MP, ML, and BI analyses grouped the caesionids within the subfamily Lutjaninae, most closely related to Macolor niger. Results illustrate a close relationship between caesionid and lutjanid taxa. However, the placement of caesionids in the Lutjanidae remains unresolved as they fall out within Lutjaninae, rendering this subfamily paraphyletic. All analyses place Paradicichthyinae as basal, rather than Etelinae. Relationships among genera within Lutjaninae remain unresolved, with the genus Lutjanus paraphyletic.

ELECTRICAL AND OLFACTORY DETECTION OF PREY BY THE YELLOW-SPOTTED STINGRAY, UROBATIS JAMAICENSIS. Mallory J. Offner & Soraya M. Bartol, Dept. of Biol., Virginia Wesleyan College, Norfolk VA 23502. There have been several studies conducted investigating the use of electoreception in elasmobranchs, particularly concerning prey capture. However, research involving the comparison of multiple senses is lacking. I set out to compare the behavioral responses of the yellow-spotted stingray, Urobatis jamaicensis, to odor and electrical stimuli through a variety of food sources. The stingray’s response time was recorded during four sets of trials using live prey (both odor and electric), dead prey (odor only), electrodes (electric only), and dead prey combined with electrodes (odor and electric). When response times are compared between the odor and electrode trials, the stingray exhibited a stronger response towards the odor. If the trials using both the odor and electrical stimuli are included, the stingray reacted more strongly when it could utilize both senses. From these data, it appears that the animal is capable of using either stimulus for prey finding behavior, however, further research needs to be conducted on multiple specimens to determine statistically if one stimulus is preferential over the other. There is potential for this research to have practical applications, as humans and elasmobranchs often interact, especially regarding fisheries (to attract or repel certain species) and animal husbandry in aquarium settings.

EFFECTS OF PREDATION RISK, DENSITY AND DISEASE ON ENERGY EFFICIENCY IN A LARVAL ANURAN. Sarah Crane & J. Vonesh, Dept. of Biol., Virginia Commonwealth Univ., Richmond, VA, 23284. Predation, density and disease affect behavior, morphology and growth. There is a lack of information on how these changes relate to efficiency of energy transfer in anuran larvae,
although previous studies suggest that predation should decrease and competition should increase efficiency. Using a 2 x 2 factorial design, I manipulated predation presence and larval density to test how predation risk and density affect energy efficiency. During the experiment, approximately half of the tadpoles were infected by an unknown disease. Neither predation risk nor density affected assimilation or growth efficiency, despite changes in growth and development. Disease, however, decreased gut length and growth efficiency. This study builds on past work on the effects of predation and density on a larval amphibian, but also introduces disease as another factor. My study suggests that disease may be at least as important if not more important than predation or density in regards to growth efficiency.

DIFFERENTIAL APPETITE-RELATED RESPONSES TO CENTRAL NEUROPEPTIDE S IN LINES OF CHICKENS DIVERGENTLY SELECTED FOR LOW OR HIGH BODY WEIGHT. Brian Prall, Wendy Calchary, Paul Siegel & Mark Cline, Department of Biology, Radford University, Radford, VA 24142. The anorexigenic 20 amino acid neuropeptide S (NPS) has not been studied in an animal model of hypo- or hyperphagia. Our study was designed to elucidate if central NPS appetite-related effects are different in lines of chickens that had undergone long-term divergent selection for low (LWS) or high (HWS) body weight and are hypo- and hyperphagic respectively. It took a longer time for food intake to be reduced in LWS than HWS chicks administered the lowest dose of NPS tested (0.14 nmol) and at the highest dose tested (0.56 nmol) they had a greater reduction in food intake than did HWS chicks. HWS chicks responded with a similar magnitude of food intake reduction that was independent of NPS dose. Although water intake was reduced concurrently with food intake after central NPS in both lines, blood glucose concentrations were not affected. Hypothalamic signalling was different between the lines. Although both lines respond to central NPS with decreased c-Fos immunoreactivity in the lateral hypothalamus, the periventricular nucleus had increased c-Fos immunoreactivity in LWS but not HWS chicks. After central NPS treatment there was increased c-Fos immunoreactivity in the paraventricular nucleus in HWS but not LWS chicks. These data support the notion of differences in the central NPS system between the LWS and HWS lines and infer that central NPS may differentially affect appetite-related processes in other species that contain hypo- and hyperphagic individuals.

SHORT-TERM ANOREXIGENIC EFFECTS OF CENTRAL NEUROPEPTIDE VF ARE ASSOCIATED WITH HYPOTHALAMIC CHANGES IN CHICKS. Wendy Calchary, Christie Bowden, Jessica Layne & Mark Cline, Department of Biology, Radford University Radford, VA 24142. The study reported here was designed to measure feed and water intake, changes in hypothalamic chemistry, and other behaviour modifications after central injection of NPVF in broiler type chicks. In Experiment 1, chicks responded to central NPVF with a reduction in feed intake for up to 90 min post injection. Water intake was not affected. In Experiment 2,
neuropeptide VF exerted a less potent and shorter duration of attenuated feed intake than did the structurally related neuropeptide FF. In Experiment 3, 16.0 nmol NPVF reversed prolactin releasing peptide (PrRP) induced orexigenic effect. In Experiment 4, central NPVF treatment was associated with decreased c-Fos immunoreactivity in the lateral hypothalamus (LH), while c-Fos immunoreactivity in the dorsomedial nucleus, infundibular nucleus (homologue to the mammalian arcuate nucleus) and ventromedial nucleus was increased. In Experiment 5, behaviours unrelated to ingestion including sit, stand, deep rest and locomotion were affected by central NPVF injection. Some of these behaviours are incompatible with ingestion and may contribute to hypothalamic associated perception of satiety after central NPVF. In conclusion, NVPF is a short term regulator of appetite and its effects are associated with hypothalamic and behaviour changes in chicks.

USE OF SNIP-MAPPING TO FIND THE GENE RESPONSIBLE FOR A CELL CYCLE EXIT MUTANT IN C. ELEGANS. Lataisia Jones & Glenn C. Harris, Dept. of Biology, Virginia State University, Petersburg, VA 23806. Non-insulin dependant diabetes mellitus (NIDDM) is one of the most significant chronic human diseases, affecting over 20 million people in the United States (7% of the population). The goal of this project is to identify the gene responsible for a cell cycle exit mutant previously identified in the nematode Caenorhabditis elegans. We proposed to accomplish this by isolating multiple recombinant strains containing the gene and using single nucleotide polymorphism (SNiP) analysis to estimate the physical distance of the mutant gene from a known landmark, the unc-101 gene. Our findings to date suggest the gene is located within a 0.6 Mb region of chromosome 1. This effort demonstrates the effectiveness of using a PCR and restriction enzyme-based methodology to localize SNiPs within the C. elegans genome.

EXPRESSION OF CAMK-II SPlice VARIANTS IN ZEBRAFISH VARIANTS IN ZEBRAFISH EMBRYONIC HEART. L. Francescatto, S. Rothschild, & R. M. Tombes, Department of Biology, Virginia Commonwealth University, Richmond, VA, 23284. Calcium Calmodulin Kinase II (CaMK-II) is a serine/threonine protein kinase that alters key substrates by phosphorylation throughout the cell. In zebrafish, CaMK-II is encoded by at least seven genes: alpha, beta1, beta2, gamma1, gamma2, delta1 and delta2 (α1, β1, β2, γ1, γ2, δ1, δ2). Different CaMK-II probes were used in zebrafish embryos and have demonstrated the temporal presence of three genes β1, β2, and αKAP. Among these genes, β2 has been found to be essential for the looping of the heart during development, while others are expressed in the heart but no further studies have been performed to discover their roles in heart development. CaMK-II contains a catalytic, variable, and association domain. The genetic sequence of CaMK-II varies depending on the combination of exons which contribute to the formation of different splice variants. At least 25 splice variants are present during zebrafish development. As a result of this alternative splicing, the
transcribed protein products may have different roles in the physiology and development of the organism. Therefore, it is of extreme importance to determine which splice variants are present in zebrafish heart. The presence of different exons can possibly help to understand the role that this protein is playing during zebrafish embryonic development. We identified two CaMK-II genes, β1, and β2, that encode splice variants present in the zebrafish heart at 48 hpf. Each splice variant includes either exon II and VII, or exon II, III, and VII. Both of these splice variants are found in the CaMK-II β1 gene, while only the splice variant containing exon II and VII is found in the CaMK-II β2 gene.

CHEMOTROPISM IN NEUROSPORA CRASSA. Philip Rock, Virginia Wesleyan College, Norfolk, VA 23502. Understanding the growth of filamentous fungi as an organized mycelial entity remains a major challenge in biology. The chemotrophic response of Neurospora crassa was investigated using an inert growth medium composed from polyacrylamide. A standard 10% acrylamide/bis-acrylamide solution (prepared in deionized water) was poured into petri dishes and allowed to polymerize. Wells were made in the center and periphery of the dish using a cork borer. Spores suspended in minimal sucrose media placed in the central well grew radially outwards in a symmetrical manner. Spores inoculated into the central well of dishes that had 50 microliters of 20X minimal media solution in the peripheral well, grew asymmetrically towards the nutrient well (positive chemotropism). Among a number of mutant strains examined, an actin mutant of Neurospora failed to exhibit such positive chemotropism. This supports a model of organized hyphal growth requiring microfilaments made from intact actin subunits. The polyacrylamide chemotropism assay may be useful in identifying additional mutants defective in the chemotrophic response and in elucidating the mechanisms of mycelial growth and chemotrophism in N. crassa.

SOURCES OF MORTALITY IN VOLUNTEER PINE TREES. Robert K. Rose & Jay Kiser, Dept. of Biological Sciences, Old Dominion University, Norfolk, VA 23529. Since December 2002, small mammals have been captured, marked, and released on an oldfield study grid in southern Chesapeake. Starting in summer 2004, we noticed dead pine trees, all of which, when inspected, had been killed by girdling. From February to April, 2005, an assistant and RKR assessed the extent of pine mortality caused by rodents, primarily hispid cotton rats, Sigmodon hispidus. We counted 15,409 pines > 0.8 m tall in an area of 1.266 ha. Of these, 2025 had been completely girdled within the past year or two, and a further 305 were killed by fresh girdling during the time of our assessments, making mortality by rodents 15.1% of pines. A further 50.0% of pines had been partially girdled and 26 pines were dead by natural causes. This unusual eating of pine bark coincided with a high density of 130-140 cotton rats per hectare. Three years later, we observed high levels of natural mortality and relatively little mortality due to girdling, so we obtained the numbers using the same methods on the same area: 16,756 pines > 0.8
m tall, 137 (0.8%) dead by girdling, and 3846 (23.0%) dead by natural mortality. A high correlation ($r = -0.995$) indicated that natural mortality was greatest where pine density was greatest.

**DISPERSION AND ORIENTATION OF CHINESE MANTID EGG CASES IN A PINE-DOMINATED OLDFIELD.** A. Scott Bellows$^1$ & Robert K. Rose$^2$, $^1$REMSA, 124 West Queens Way, Hampton, Virginia 23669, $^2$Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529-0266. The Chinese mantis, *Tenodera aridifolia sinensis*, is a univoltine tritrophic predator of oldfields. In three years of study of a population in eastern Virginia, we observed several unusual features in this introduced insect. More than 90% of egg cases were deposited in shrubs and trees, many at heights $> 2$ m. Egg cases were non-randomly oriented (to the south), but with no significant association between compass orientation and days to hatching of young. Egg cases were uniformly dispersed but least dense in open patches, the opposite of expectation for an oldfield insect. Smaller egg cases yielding fewer, later-hatching, but not lighter young when oriented towards the south. Together these features suggest that some females produce $> 1$ egg case, with later egg cases being smaller and with fewer eggs because of reduced food with which to make eggs, and are oriented to the south for greater metabolic efficiencies when the sun is moving progressively lower in the horizon in autumn. The result is temporal as well as spatial dispersion of hatchlings in spring.

**SPOTTED SEATROUT AND THE ENVIRONMENT: THE STABLE ISOTOPE LINK.** Renée Reilly$^1$, Cynthia M. Jones$^1$, Robert F. Dias$^2$, & William E. Thompson$^1$. $^1$Center for Quantitative Fisheries Ecology, Old Dominion University, Norfolk, VA 23259 $^2$Department of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA 23529. Seagrass beds are commonly referred to as nursery habitats for juvenile fish, but the direct value of seagrass habitat to fisheries has not been directly quantified. Defining the link between juvenile fish fitness and the quality of the habitat in which they live is an integral part of quantifying the value of seagrass-nursery habitats. To examine this relationship, we are investigating the influence of carbon (C) and nitrogen (N) sources on juvenile fish growth over a three year period (2006-2008). To conduct this research, we chose the tightly coupled system of juvenile spotted seatrout (*Cynoscion nebulosus*) in lower Chesapeake Bay seagrass beds. We analyze stable isotopes in the water to evaluate C and N sources, while analyzing C and N in the fish muscle tissue as indicators of trophic structure. We will subsequently track the survival of these fish as part of our NSF funded spotted seatrout mortality research. Our preliminary results show significant differences in the stable isotope signatures of spotted seatrout in our three different sampling zones in the Chesapeake Bay. While our study will continue through 2008, we already have evidence that demonstrates how various C and N sources in seagrass habitats are reflected through the trophic levels, as dietary
components are assimilated into fish muscle tissue. With further evidence we hope to demonstrate the value of seagrass nurseries and provide a method for quantifying those areas with the most productive conditions for fish growth and subsequent survival.

Providing Quantitative Metrics for Marginal Increment Analysis (MIA) to Validate Annulus Formation. C. Morgan\(^1\), N. Prista\(^2\) & C. M. Jones\(^1\), \(^1\)Center for Quantitative Fisheries Ecology, Old Dominion University, Norfolk, VA 23508, \(^2\)Centro de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal. Fish ages are typically determined by counting growth rings (“annuli”) in calcified structures such as otoliths. For ages to be accurate, the periodicity of annuli deposition must be validated. The most common method for validating periodicity in annulus formation is Marginal Increment Analysis (MIA). To this date, MIA interpretations have relied on subjective graphical interpretations and a sound statistical background has never been given to this validation technique. In this study, we perform a first-ever application of statistical time-series analyses to marginal increment data, using spot (Leiostomus xanthurus) otoliths as a case study. Using the periodogram and seasonal-trend decomposition based on loess, we successfully identify an annual periodicity in spot annuli, as well as a decreasing trend in mean marginal increment size and a slight shift in the seasonality of annulus deposition through ages. We conclude that these methods of time-series analysis provide a reliable statistical framework for MIA application and suggest their generalized application in MIA of calcified structures.

Metagonimoides oregonensis (Class: Trematoda) Infection in Larval Amphibians. Lauren R. Fischer & Lisa K. Belden, Department of Biological Sciences, Virginia Tech, Blacksburg, VA 24061. There are approximately 24,000 species of parasitic trematodes (flatworms) in the world. Yet aside from the few species that directly infect humans or livestock, we know very little about most of them. Most trematodes have complex life cycles involving multiple host species. The species that is the focus of our research is Metagonimoides oregonensis, which uses raccoons as definitive hosts, where sexual reproduction occurs, and stream snails and amphibians as intermediate hosts. Some variation regarding the life-cycle has been noted for populations in the western vs. eastern U.S. Our study objective was to begin exploring the impact of M. oregonensis infection on second intermediate host amphibians. We experimentally examined the ability of M. oregonensis cercariae from North Carolina to infect Rana spp. tadpoles, but did not see any evidence of infection. We also examined infection rates in larval stream-dwelling salamanders, Desmognathus quadramaculatus and compared the number of visible cysts on live animals versus the total number of cysts identifiable after clearing and staining. There is a strong correlation between these variables, which will allow us to study infection dynamics.
in natural salamander populations over time. Our other future plans include sequencing of *M. oregonensis* across the entire species range, establishing its life cycle in the laboratory, and continued monitoring of amphibian infection rates.

EXAMINING LINKS BETWEEN WATER QUALITY AND STRESS HORMONES IN EASTERN SPOTTED NEWTS. Kristen M. Scheller, Kim S. Kirkbride, David L. Chambers, Ignacio T. Moore & Lisa K. Belden, Department of Biological Sciences, Virginia Tech, Blacksburg, VA 24061. The population declines and range reductions experienced by amphibians in the past decades have led to questions concerning the causes of these declines. In addition to natural population fluctuations, several anthropogenic factors are being considered, some of which include alterations in water quality. This project examined the correlation between the physiological stress response, as measured by circulating levels of the hormone corticosterone, and pond water quality among several populations of Eastern spotted newts (*Notophthalmus viridescens*) in Southwestern Virginia. Both baseline and stress-induced (30 min confinement) blood samples were collected in the field (n=6-7 newts/site, 5 sites) and analyzed for corticosterone levels using radioimmunoassay. Dissolved oxygen and pH measurements of the five ponds included in the project were taken in the field. Corticosterone levels were significantly elevated following the 30 min confinement. In addition, the response to confinement varied among sites, with individuals in one population seemingly unable to mount a stress response with confinement. This suggests this population is not living in optimal conditions. Further research is needed to determine what factors contribute to the variation of the stress response between sites.

CENTRAL CALCITONIN GENE RELATED PEPTIDE CAUSES HYPOTHALAMIC ASSOCIATED ANORECTIC RESPONSES IN *GALLUS GALLUS*. Wendy Calchary & Mark Cline Department of Biology, Radford University, Radford, VA 24142. Calcitonin gene-related peptide (CGRP), consisting of 37 residues, is found in the gastrointestinal tract and causes reduced feed intake in mammals. Its effects in the avian class are unreported. We found that intraceberoventricular (ICV) injection of CGRP caused a linear decrease in feed and water intake in Cobb-500 chicks. We determined that the effect on water intake was secondary to feed since feed-restricted chicks did not have reduced water intake. Next, we found that an intaperitonal (IP) injection of CGRP reduced feed intake, but did not affect water intake. In order to determine if the hypothalamus was associated with these affects we examined c-Fos immnoreactivity in several key appetite-related nuclei. Both ICV and IP CGRP caused activation of paraventricular, periventricular and ventromedial hypothalamic nuclei, the homolog of the mammalian arcuate nucleus. The results demonstrated that CGRP causes anorexigenic effect in chicks and the hypothalamus is involved.
CENTRAL CALCITONIN CAUSES ANOREXIGENIC EFFECTS IN CHICKS. Jessica Layne & Mark Cline Department of Biology, Radford University, Radford, VA 24142. Plasma concentration of calcitonin is increased following a meal. In mammals, peripheral and central calcitonin reduce feed intake. However, to our knowledge its effects in birds are unreported. Through a series of experiments we have found that central calcitonin lowers feed intake in broiler-type chicks but does not effect water intake. Calcitonin-treated chicks also responded with decreased feed pecks while other behaviors (exploratory pecks, jumps, defecations, locomotion and the amount of time spent standing, sitting, perching or in deep rest) were not affected by treatment. Calcitonin-treated chicks had increased pecking efficiency. Finally, c-Fos immunoreactivity was quantified in classically appetite-related hypothalamic nuclei. Calcitonin increased reactivity in the arcuate nucleus, dorsomedial nucleus and ventromedial hypothalamus; nuclei that are associated with satiety perception. These data support that satiety after central calcitonin is likely primarily hypothalamic in origin and not secondary to activation of some other behavior.

OSMOTIC FRAGILITY OF LIPOSOMES. Danielle Neal & Stephen Gallik, Department of Biological Sciences, University of Mary Washington, Fredericksburg VA 22401. The goal of the research project described here is to develop a simple spectrophotometric assay, similar to the classic red blood cell osmotic fragility test, that could be used to study the short-term and long-term stability of cell-size liposomes. The specific objectives of this research project are two-fold: a) to identify a suitable non-toxic marker that can be encapsulated in cell-size liposomes and that can be detected with visible-light spectrophotometry, and b) to identify the optimum wavelength of light to be used to detect the release of the marker upon liposome lysis. Liposomes were generated using a simple rotary evaporation procedure in which phosphatidylcholine, chloroform, methanol, and an aqueous solution containing a candidate marker were added to a round bottom flask. Rotary vacuum evaporation over a two-minute period removed the organic phase, during which time liposomes formed. Samples from each product were evaluated with a light microscope and digitally photographed. Attempts to encapsulate crude isolates of hemoglobin from sheep red blood cells, a seemingly ideal candidate marker, failed. The massive amounts of debris that accumulated in the product suggests that protein denaturation and aggregation perhaps occurred. Attempts to encapsulate an alternative marker, common red food dye, which contains the nontoxic pigment allura red AC, were successful. Spectrophotometric analysis of osmotically-induced lysis of liposomes containing red food dye showed that wavelengths of visible light between 450nm and 480nm and between 580nm and 620nm could be used to monitor the release of the marker during liposome lysis.

CHARACTERIZATION OF A NATURALLY OCCURRING ARTEMISININ RESISTANT PLASMODIUM FALCIPARUM CLONE. Ghislaine Mayer &
Maimuna Bruce, Dept. of Chemistry, Virginia Commonwealth University, Richmond, VA, 23284. Malaria has been a prevailing health problem in many countries around the world and is caused by protozoan parasites from the genus *Plasmodium*. One such protozoan is *Plasmodium falciparum*, one of the most widespread protozoan parasites causing malaria in humans. The *Plasmodium* life cycle contains four blood stages, the ring, trophozoite, schizont, and gametocyte, which is the precursor to the sexual stage that mosquitoes are able to transmit. Due to its health impact, there have been numerous anti-malarial drugs on the market to combat the effects of this disease. Some strains of *P. falciparum* have developed resistance to these drugs such as Dd2Nm and FCR3, while others have remained sensitive such as HB3. Artemisinin, or qinghaosu, is a native Chinese drug, derived from the herb *Artemisia annua*. It has been used against chloroquine-resistant and sensitive strains of *P. falciparum*, and is known to be effective at a low nanomolar concentration. Its usefulness has been shown to increase when combined with other synthesized anti-malarial drugs. Because of its short half life, resistance is thought not to happen readily.

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**Botany**

CORRELATIONS BETWEEN PLANT COMMUNITY AND WATER TABLE PARAMETERS: A NEW PERSPECTIVE ON OLD FIELD SUCCESSION. Krista C. Sweet, Herman W. Hudson & Robert B. Atkinson, Center for Wetland Conservation, Dept. of Biology, Chemistry and Environmental Science, Christopher Newport University. In the United States, destruction of wetlands requires a permit, which may require wetland replacement often involving restoration of lands that were drained for agriculture. The federal manual for wetland delineation provides some of the success criteria for mitigation sites, and uses plant dominance to assess vegetation and, for hydrology, evidence of inundation or saturation to within 30 cm of the soil surface for a minimum of 5% of the growing season. The purpose of this study was to evaluate the use of a prevalence index for the plant community by comparison to water table parameters in a proposed mitigation site. Correlation between plant community and water table parameters were analyzed in a 6.5 ha (16.2 ac) former agricultural field in Mathews County, VA prior to its restoration. Fifteen PVC pipe wells were hand augered to an approximate depth of 1m. The wells were then sealed, surveyed, and sampled weekly from March through August 2007. In August 2007, plant community dominance was evaluated in three 1-m² subplots adjacent to each well. The relative cover and indicator status of each species (obtained from the USDA Region 1 Plant List) in each plot were used to calculate a prevalence index. A linear regression was then performed on the mean
prevalence index of each plot versus the percentage of inundation or saturation during the growing season and results were negatively related ($r^2=0.38$, $P < 0.05$). Based on the vegetation prevalence index at the site, nearly half of the site may come to support wetland communities even if no hydrologic modification is attempted. Results suggest that a prevalence index may be used to assess restoration potential in some agriculture fields.

ROLE OF FLORISTIC QUALITY INDEX IN UNDERSTANDING PLANT COMMUNITY DEVELOPMENT IN RESTORED WETLANDS. Jessica M. Campo, Jackie D. Roquemore & Robert B. Atkinson, Center for Wetland Conservation, Dept. of Biology, Chemistry and Environmental Science, Christopher Newport University. Establishment of appropriate wetland vegetation is a common objective in restoration but sometimes difficult to achieve. In summer 2007, six wetland compensation sites of the Virginia Aquatic Resource Trust Fund were investigated. The VARTF focuses site selection on wetland restoration areas within targeted corridors. Sites ranged in age from 3 to 7 years post construction and were 1.8 ha to 49.4 ha in size. Using a class system to estimate colonizing vegetation cover (dominance), we analyzed species richness, conservation values (C-values), and Floristic Quality Index (FQI) values in 501 randomly established 1-m$^2$ plots. The number of species per plot averaged 6.4 (SE +/-0.36, range 5.3 – 7.6) and the number of species per site averaged 62 (SE +/-6.6, range 42 – 89). C-values were based on the Virginia Wetland Plants C-Value List and represent a species likelihood of occurrence in pristine versus disturbed sites. Based on a 0-10 scale, the average C-value per site was 3.0 (SE +/-0.27, range 2.7 – 3.2). Our estimates of high species richness, low average C-values and low FQI values are similar to those reported in the literature for young restored sites and likely represent a colonization phase in early site development. The dominance of native species may result from favorable site selection practices that (1) prioritize wetland restoration over creation and (2) identify natural corridors in an effort to restore ecological integrity at the landscape scale.

PLANT COMMUNITIES IN RESTORED NONTIDAL WETLANDS: THE RELEVANCE OF CYPERACEAE, JUNCACEAE AND POACEAE. Jackie D. Roquemore, Brittany A. Chilton & Robert B. Atkinson, Center for Wetland Conservation, Dept. of Biology, Chemistry and Environmental Science, Christopher Newport University, Newport News VA 23606. Current state and federal policies require that wetlands lost to development be replaced by restoration, creation, or similar activities. Monitoring of replacement wetlands typically focuses on establishment of hydrophytic plant communities. However, newly restored or created wetlands are colonized by a floristically diverse assemblage often including taxonomically challenging graminoids (families Cyperaceae, Juncaceae and Poaceae). In this study of eight restored non-tidal wetlands in Virginia herbaceous species were censused within 636 randomly selected 1-m$^2$ plots. The dominance
and richness of Cyperaceae, Juncaceae and Poaceae were quantified. An average of 19.25 +/- 4.7 graminoids were identified and 72% of these species were hydrophytes. Results suggest that misidentification or other errors associated with this group could lead to mischaracterization of successful wetland replacement.

POTENTIALLY HARMFUL PHYTOPLANKTON WITHIN VIRGINIA TIDAL TRIBUTARIES: BLOOM AND TOXIN PRODUCERS. Harold G. Marshall, Todd Egerton, Robert Johnson, Matthew Semcheski & Nathan Bowman. Dept. of Biological Sciences, Old Dominion University, Norfolk, VA 23529-0266. Monitoring phytoplankton populations since 1985 has provided us significant data regarding their composition, distribution, abundance, and bloom development within Virginia tributaries and the Chesapeake Bay. These include a variety of nontoxic bloom producers. However, of 38 potentially harmful species identified, *Microcystis aeruginosa*, *Karlodinium veneficum*, and *Cochlodinium polykrikoides* are currently among other taxa as common bloom producers within Virginia tributaries and there are indications of their increasing presence and expanding range of development. Major blooms of *M. aeruginosa* occur annually in the Potomac R., extending into oligo-mesohaline regions with concentrations reaching 10^5 cells ml^{-1}, and often accompanied by high levels of microcystin. In recent years blooms (10^5 cells ml^{-1}) of the toxin-producing *K. veneficum* have also occurred in the Potomac R. system, and we have verified its presence in other Virginia rivers at lower concentrations. Over the past decade the range and bloom development of *C. polykrikoides* has increased to becoming a major annual bloom producer (10^3 cells ml^{-1}) in rivers along the southwestern shoreline of Chesapeake Bay, including the Virginia Beach ocean front. In summary, algal blooms are common events in these waters, responding to favorable environmental conditions of temperatures, salinity and nutrient levels. Among these bloom producers are potentially harmful species. Supported by the Virginia Department of Environmental Quality and the Virginia Department of Health.

PRE- AND POST-HURRICANE COMPOSITION IN A HARDWOOD FOREST. Kjarstin A. Carlson-Drexler & Stewart A. Ware, Dept. of Biology, College of William and Mary, Williamsburg, VA, 23185. On September 18, 2003, Hurricane Isabel passed over Williamsburg, Virginia. This storm produced a multi-hectare microburst in the College Woods of the College of William and Mary in Williamsburg, Virginia. No salvage logging occurred in the damaged areas, leaving trees where they fell during the storm. In 2006, permanent plots were set up in the microburst and surrounding intact forest ("reference"), and tree species and size were recorded for all individuals larger than 5 cm diameter at breast height (1.4 m). Trees were placed into several damage categories, and were classified as "lost" if they were snapped off or otherwise below breast high. Chi-square and Fisher's Exact analyses were performed on damage and loss values for each species in each area. In the microburst area, *Quercus rubra* lost significantly more individuals and
experienced more damage than expected, while *Ilex opaca* lost significantly fewer individuals and experienced less damage than expected. In the reference area, no species lost significantly more or fewer individuals than expected. These results show that following a disturbance, composition reconstruction is possible even without pre-disturbance plots, as long as salvage logging does not take place. Additionally, pre-disturbance reconstruction may provide a more valuable comparison to post-disturbance composition than does nearby, less disturbed habitat.

**ADAPTATION TO SOIL TYPE IN ROCK OUTCROPS: CROTONOPSIS ELLIPTICA AND CROTON MONANTHOGYNUS.** Stewart A. Ware, Dept. of Biology, Coll. of William and Mary, Williamsburg, VA 23187-8795. In eastern North America where rock is at or near the soil surface and trees are excluded, herbaceous plants dominate the vegetation. Extreme summer drought, wintertime soil saturation, and extreme soil chemistry exclude many common open-area weeds. As a result, especially adapted endemic species characterize the shallow soil flora of rock outcrop areas. However, a few widespread weeds do occur in the shallow soil zones, such as *Crotonopsis elliptica*, present only on sandstone and other acidic outcrops, and *Croton monanthogynus*, abundant on limestone. To determine whether *Crotonopsis* was excluded from limestone outcrops by soil type intolerance or by competition from *Croton*, each species was grown experimentally in a greenhouse in its own and the other's soil type. *Crotonopsis* was greatly inhibited by limestone soil (growth reduced by 75%) and looked sickly. *Croton* grew less well on sandstone than on limestone (reduced by 25%), but plants looked healthy. *Crotonopsis* is no doubt excluded from limestone outcrops by soil type intolerance, while *Croton* may be unimportant on sandstone outcrops because of its mild intolerance or, more likely, a weakened competitive ability on sandstone. The work was done in part at the University of Arkansas, supported by a Faculty Research Grant from the College of William and Mary.

**HERBARIUM SPECIMENS AS ART: ANATOMY OF AN EXHIBITION.** W. John Hayden, Dept. of Biology, Univ. of Richmond, 23173. Planning, development and implementation of an exhibition titled “Native Plants of Virginia: Selections from the University of Richmond Herbarium” is described. Planning was initiated by University Museum staff and the herbarium curator at the University of Richmond in June 2005 for an exhibition focused on Virginia native plants as part of Jamestown commemoration events of 2007. An early vision featured species displayed via an herbarium specimen, a photograph of the plant from nature, and a line drawing, with each element of the display given more or less equal prominence. As the exhibit developed, herbarium specimens received greater and greater emphasis, perhaps because of their novelty as art objects. Line drawings were the work of L. C. Gastinger (produced for the upcoming *Flora of Virginia*) and were retained for approximately one third of the species displayed. Photographs (by W.
J. Hayden) were reduced to mere thumbnail images on display legends (known as "chat labels"). Display legends provided formal scientific and common names and touched on various aspects of the biology of the plants featured: morphology, ecology, pollination mechanisms, and utility to humans were common themes. Also, as appropriate, legends featured curatorial information about the specimens, label data, collectors, annotations, etc. Opening of the exhibit was marked by a "gallery talk" titled "From Flower to Flora: The Nuts and Bolts of Floristic Botany" which endeavored to explain the role of herbarium specimens in the study of flora (the plants in nature) and the production of floras (books about plants). Later, during the run of the exhibition, artist L. C. Gastinger conducted a botanical illustration workshop. The exhibit was open to the public February 28 to July 13, 2007 during which time it was viewed by 1745 people who, it is hoped, learned something about native plants, botanical field work, herbaria and floras while also enjoying the aesthetic qualities of well-prepared herbarium specimens.

THE GENUS BISCHOFIA BLUME (PHYLLANTHACEAE/EUPHORBIACEAE), ADVENTIVE IN NORTH AMERICA. W. John Hayden, Dept. of Biology, Univ. of Richmond, 23173. Relationships, morphology, native and adventive US ranges, and possible ecological threats posed by Bischofia javanica are reviewed as a contribution towards the eventual treatment of Euphorbiaceae sensu lato in the Flora of North America project. Bischofia has traditionally been classified in Euphorbiaceae subfamily Phyllanthoideae, which is now recognized as family Phyllanthaceae. Two species are known but only Bischofia javanica, native to regions from India and China, to the Phillipines, Australia, and Melanesia, occurs in North America. Bischofia javanica has been cultivated for decades in Florida, as far north as Alachua County. The tree is now naturalized in coastal counties of Florida from Sarasota to Cape Canaveral. Bischofia has been planted rarely in southern California where it shows no sign of naturalizing. The plants are dioecious trees with pinnately trifoliolate leaves. Staminate flowers are produced in large panicles; each is minute, with five imbricate sepals, five stamens and a central 5-angled pistillode. Pistillate inflorescences are also paniculate; each flower consists of a 3-carpellate gynoecium surrounded by 5 free sepals. Fruits are drupaceous, typically bearing six ecarunculate seeds (two per carpel). Commonly known as Bishop Wood, Bischofia javanica was once promoted as a street tree, but its propensity to outgrow small residential lots, to develop irregular canopies with age, to host numerous leaf-spot diseases and insect pests, coupled with its invasive tendencies, now make it undesirable. Nevertheless Bischofia javanica appears to be a well-established element of Florida's naturalized flora.

NATIVE AND ADVENTIVE SPECIES OF MANIHOT MILL. (EUPHORBIACEAE) IN NORTH AMERICA. W. John Hayden, Dept. of Biology, Univ. of Richmond, 23173. Species of the genus Manihot in North America north of Mexico are under study as a component of the eventual treatment
of Euphorbiaceae in the Flora of North America project. A total of six species occur within the continental US; four are native and two cultivated species show varying degrees of becoming naturalized. Southern Arizona hosts two hemicryptophyte species: *M. davisiae*, characterized by broad pandurate leaf lobes and *M. angustiloba*, characterized by narrow, linear, leaf lobes and spinose tips; both of these species range widely to the south in Mexico. Southern Texas has two species: *M. subspicata*, a low shrub with terminal inflorescences and smooth fruits and *M. walkerae*, a hemicryptophyte with axillary inflorescences and verrucose/rugose fruits. *Manihot walkerae* is globally rare. Both Texas species also occur in nearby regions of Mexico. *Manihot grahamii*, native from southeast Brazil to northern Argentina is frost tolerant; stems die to the ground in winter but rejuvenate robustly in the spring. *Manihot grahamii* can be cultivated outdoors as far north as Raleigh, North Carolina and it is naturalized sporadically throughout the Gulf coast region. *Manihot esculenta*, the source of manioca and tapioca, native to tropical America and now cultivated throughout the tropics, is occasionally cultivated in frost-free areas along the Gulf coast where it may escape to a limited extent; it can be recognized by its robust shrubby habit, swollen nodes, and entire-lobed leaves with glaucous/reticulate undersurfaces.

THE FLORA OF VIRGINIA PROJECT: A 2007-2008 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 1743, 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 nearly 300 of the core illustrations, has been commissioned, completed, and funded by VAS funds. An $80,000 grant from the Virginia Environmental Endowment Fund is available to support development of The *Flora of Virginia*. The Academy, including the Fellows, continues to provide essential support, including financial support, for this Project. Other progress includes completion of treatments of the dichotomous keys of 155 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 53% complete, and the third and final step of species and genus descriptions is 40% completed. The projected publication date is late 2011 or early 2012.

NATURAL HISTORY OF HAWAIIAN PLANTS: USING MOLECULAR DATA TO UNRAVEL ISLAND EVOLUTION. Timothy J. Motley, The J. Robert Stiffler Professor of Botany, Dept. of Biological Sciences, Old Dominion University,
The Hawaiian Islands are the most isolated archipelago in the world. Because they are volcanic and formed as the Pacific tectonic plate moved over a hotspot in the Earth’s crust, the islands have never been in contact with any other land mass. All life on Hawaii has arrived via long distance dispersal. These colonizers, if successful, found open habitat niches, relaxation of selective pressures, and reductions in competition and reproductive barriers which many organisms exploited. Sherwin Carlquist in his famous books *Island Life* and *Island Biology* documented many adaptations common among island organisms, e.g., gigantism, loss of dispersal, insular woodiness, and adaptive radiation. The fauna of the islands have given rise to flightless flies, no-eyed, big-eyed spiders, and an extinct 2 m tall goose. The flora also has become one of the most extraordinary in the world, and includes: the silverswords; giant, Seussian lobelias; tree-sized spurge and blue; unscented, fleshy-fruited mints; and woody violets and plantagos. Recent molecular systematics studies have investigated some of these novel morphological adaptations, the geographical origins of many of these lineages, and tested the theories of island evolution. This paper will discuss the recent insights from molecular plant systematics and provide a photographic overview of the spectacular Natural History of the Hawaiian Islands.

**BOTANICAL RESEARCH IN THE GALÁPAGOS ISLANDS - PRIORITIZING FUTURE STUDIES.** Conley K. McMullen, Dept. of Biology, James Madison University, Harrisonburg VA 22807 & Alan Tye, South Pacific Environment Programme, Samoa. The Galápagos Islands, made famous after Charles Darwin's visit in 1835, have a long and varied history of botanical exploration and research. Since the establishment of the Charles Darwin Foundation in 1959, the Charles Darwin Research Station in 1964, and the Galápagos National Park Service in 1968, a tremendous amount of botanical research has been accomplished through the collaborative efforts of these organizations, visiting scientists, and local and international volunteers. The direction of this research has often been determined by the council of various experts who have, from time to time, met to discuss and prioritize the various areas and needs of botanical studies in the archipelago. In this presentation, we discuss the major emphases of previous botanical studies in the islands and list our recommendations of crucial areas of botanical research needing to be addressed in the upcoming years.

**ANTIOXIDANT ACTIVITY IN SELECTED DOMESTIC AND IMPORTED WINES.** Lindsay E. Deliman & Michael H. Renfroe, Dept. of Biology, James Madison University, Harrisonburg VA 22801. A strong correlation has been reported between disease prevention and antioxidants. Wine is one source of antioxidants in many human diets. The type of grape, fermentation and processing of wines, and vineyard location are all factors that may lead to variations in antioxidant content of wines. For example, red wines include the grape skins, a strong source of antioxidants, throughout the entire process while white and rosé do
not. By testing the antioxidant activity in fourteen various wines from the regions of California, Australia, and North Carolina, differences were noted about their antioxidant content. The antioxidant activity was measured by using the ABTS/H$_2$O$_2$/HRP decoloration method. Trolox, a well characterized and stable antioxidant, was used as a comparative standard for wine antioxidants. The highest antioxidant contents were found to be in an Australian shiraz, with a mean of 16.90 µmol TE (Trolox equivalents) /ml, and Californian merlot, with a mean of 14.66 µmol TE/ml. The second highest antioxidant content resided in North Carolina muscadine-based red wine, which had a mean of 5.50 µml TE/ml. A Californian white zinfandel had a mean of 1.44 µmol TE/ml, which is lower than the Australian chardonnay, which had a mean of 1.72 µmol TE/ml. These means display the increase in the antioxidant content in red wines from white wines. The wines with the least color, such as a white or rosé, generally contained the least concentration of antioxidants. Results indicate that wines vary greatly in their antioxidant content.

HYDROPHILIC ANTIOXIDANT ACTIVITY IN BREWED COMMERCIAL TEAS. Michael H. Renfroe, Kaitlyn Watson, Leena Khan & Anna Dinh, Dept. of Biology, James Madison Univ., Harrisonburg, VA 22807. Teas are consumed as part of healthy diets in part due to the presence of antioxidants which are thought to help prevent various chronic diseases and provide multiple health benefits. We analyzed the antioxidant content of various black, oolong, green, and white teas prepared from *Camellia sinensis*. We also analyzed a variety of herbal teas. Antioxidant content was measured using the ABTS/H$_2$O$_2$/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. We sampled five black teas, three oolong teas, seven green teas, one white tea, and five herbal teas including peppermint (*Mentha piperita*) and boldo (*Peumus boldus*). Antioxidant content varied widely among teas. There was significant lot-to-lot variation within a given brand of tea as well as brand-to-brand statistically significant differences. Antioxidant content varied from 27 to 704 µmol trolox equivalents/g fw of tea. Variability of antioxidant content among teas suggests that further studies should be conducted to determine the sources of variation. These results also indicate that antioxidant testing should be more extensively repeated with a variety of samples and that results should be reported as ranges rather than as absolute values. Studies of antioxidant content in brewed beverages can provide information helpful to planning healthy diets.

SCHOOL GROUND GARDENS IN THE CITY OF RICHMOND, VA. Leonard O. Morrow, volunteer. A pilot project of hands-on gardening has been initiated with 3 elementary schools and one technical high school in the City of Richmond. Raised beds and containers on solid surfaces, or landscape fabric, have been used to grow decorative and food plants with student/teacher involvement and SOL applications. Summer water supply is the most critical factor for survival of plants.
The urban gardens on public school grounds may benefit lessons leading to crime prevention, and is one response to the Nature Deficit Disorder phenomenon.

**INVESTIGATIONS INTO VEGETATIVE PROPAGATION OF THE NATIVE SHRUB *SYMPLOCOS TINCTORIA* (L.) L'HER. (SYMPLOCACEAE).** Dana R. Reynolds & Linda MK Johnson, Dept. of Biology, Chemistry and Environmental Science, Christopher Newport University, Newport News, VA 23606. Native plants are often difficult to locate for ornamental uses due to problems with or ignorance of effective propagation methods. We investigated the vegetative propagation of an underused understory shrub known as Horsesugar or Sweetleaf (*Symlocos tinctoria*). Using mid-summer, semi-hardwood straight and heel stem cuttings and applying different types of rooting hormones, we achieved the best rooting success with straight stem cuttings using Hormodin 3 and Dip 'N Grow 1000ppm rooting hormones.

**DESIGNING A VISITOR-FRIENDLY CAMPUS ARBORETUM WEBSITE.** Kenton A. F. Buck, Megan M. Hudson, Abigail C. Thomas, W. Tyler Warren & Linda MK Johnson, Dept. of Biology, Chemistry and Environmental Science, Christopher Newport University, Newport News, VA 23606. Cross-disciplinary projects require a well-defined set of goals as well as active collaborators willing to assume responsibility for their part of the workload. Our group’s goal is to generate a website that allows visitors to explore and learn about the wonderful selection of plants installed on CNU’s campus. In order to achieve this objective, we are enlisting campus experts in GIS-mapping, plant identification, and website development. This presentation illustrates the educational and web-graphic goals of the project as well as the coordination efforts required in the preliminary stages of this ambitious project.

**Chemistry**

**UNDERSTANDING THE REACTIVITY OF EBSELEN USING SAPE AND DFT METHODS.** Craig A. Bayse & Sonia Antony, Dept. of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA 23539-0126. The reactivity of ebselen in biological system is computationally investigated using DFT method with the inclusion of (solvent assisted proton exchange) SAPE network. The activation energy is lowered with the use of SAPE network. The energy also varies with the number of water molecules used in the SAPE network.

Malaria has been a prevailing health problem in many countries around the world and is caused by protozoan parasites from the genus *Plasmodium*. One such protozoan is *Plasmodium falciparum*, one of the most widespread protozoan parasite causing malaria in humans. The *Plasmodium* life cycle contains four blood stages, the ring, trophozoite, schizont, and gametocyte, which is the precursor to the sexual stage that mosquitoes are able to transmit. Due to its health impact, there have been numerous anti-malarial drugs on the market to combat the effects of this disease. Some strains of *P. falciparum* have developed resistance to these drugs such as Dd2Nm and FCR3, while others have remained sensitive such as HB3. Artemisinin, or qinghaosu, is a native Chinese drug, derived from the herb *Artemisia annua*. It has been used against chloroquine-resistant and sensitive strains of *Plasmodium falciparum*, and is known to be effective at a low nanomolar concentration. Its usefulness has been shown to increase when combined with other synthesized anti-malarial drugs. Because of its short half life, resistance is thought not to happen readily.

NUCLEOPHILIC SUBSTITUTION MECHANISMS – TRANSITION STATES. Charles M. Bump. Department of Chemistry, Hampton University, Hampton, VA 23668. The purpose of this work is to examine nucleophilic substitution reactions in order to better understand and differentiate between *S_N1* and *S_N2* type reaction mechanisms. Semi-empirical (AM1) transition states were generated for nucleophilic substitution reactions (gas phase) reactions of alkyl halides using MOPAC. The influence of nucleophile and leaving group as well as the structure of the substrate (methyl, ethyl, isopropyl, sec-butyl, tert-butyl) will be discussed.

INVESTIGATING THE BASIS OF NATURAL ORGANIC MATTER PHOTOCHEMISTRY. Amy K. Carfagno & Charles M. Sharpless, Dept. of Chem., University of Mary Washington, 1301 College Avenue, Fredericksburg, VA 22401. In natural waters, absorption of sunlight by natural organic matter (NOM) results in production of reactive oxygen species such as singlet oxygen ($^1O_2$) and hydrogen peroxide ($H_2O_2$). The proposed reaction pathway involves interaction of excited state NOM (NOM*) with molecular $O_2$. Energy transfer from NOM* to $O_2$ forms the highly reactive singlet oxygen ($^1O_2$); NOM* may also reduce $O_2^-$, producing $O_2^-$, which dismutates to $H_2O_2$. The absorbance spectra of NOM are characterized by the E2/E3 ratio, the absorbance at 254 nm divided by that at 365 nm. Previous research in our lab showed a strong positive linear correlation between the quantum yield of $^1O_2$ and E2/E3. The present project extends the research to $H_2O_2$ quantum yields. Our results indicate that lowering the E2/E3 ratio by increasing pH leads to higher $H_2O_2$ quantum yields. This seems to suggest that long-wavelength light absorption by NOM favors electron transfer to oxygen but
disfavors the kind of energy transfer that leads to $^1O_2$. Electrochemistry experiments were also conducted to gain insight into the link between NOM redox properties and photochemical reactivity; however, cyclic voltammograms of NOM solutions do not reveal distinct peaks above the background. The small, broad peaks that are observed may be overlapping multiple redox transitions of the diverse functional groups in NOM.

AQUEOUS NANOMATERIALS: SYNTHESIS, STABILITY, AND FILM GROWTH. R. Day, A. Galyean, C. Dowdy, & M. Leopold, Department of Chemistry, University of Richmond, Richmond VA 23173. Much interest exists in utilizing the unique properties of nanomaterials for improving the sensitivity and efficiency of biological and chemical sensors. Thin films of nanomaterials that can swell or contract in the presence of a specific analyte are currently being explored for this purpose. This report describes the successful design of thin, air-stable film assemblies comprised of aqueous gold nanoparticles with electrostatic-based, polymeric linking mechanisms. The films preserve the versatile properties of nanoparticles, including the ability to be easily functionalized, while incorporated into a flexible film—properties suggesting potential sensing applications such as metal ion detection in aqueous solution. Film growth dynamics and stability were assessed by the characterization of the film’s surface plasmon band, which is dependent upon the inter-particle spacing and local environment of the nanoparticles within the film. The feasibility of incorporating other nanomaterials into these film systems, specifically hollow gold nanoshells, recently shown to exhibit an increased optical sensitivity to changes in its local environment, is also reported.

ADSORPTION OF NITRIC ACID ON BOEHMITE M.W. Ross and T.C. DeVore, Dept of Chem. And Biochem. MSC 4501, James Madison University, Harrisonburg VA 22807, Solid state Fourier transform infrared spectroscopy (FTIR), evolved gas analysis-FTIR (EGA-FTIR), thermal gravimetric analysis (TGA) and differential scanning calorimetry (DSC) were used to investigate the desorption of nitric acid from boehmite. Samples containing up to 36% adsorbed nitric acid by mass were prepared by placing the mineral in 70% nitric acid solution. FTIR established that water solvated nitrate was the main species adsorbed on the surface. The water solvated nitrate vaporized as nitric acid at ~ 400 K with an enthalpy of desorption of ~ 50 kJ/mol. A second nitric acid desorption occurred at ~ 450 K and had an enthalpy of desorption of 85 kJ/mol was assigned as desorption of partially solvated aluminum hydroxylated nitrate. Monodentate and bridging nitrate desorbed at ~ 725 K as NO$_2$ and O$_2$ with an enthalpy of reaction of ~ 55 kJ/mole NO$_2$ desorbed.

SUBUNIT STRUCTURE OF THE CLONED HUMAN GUANINE-7-METHYLTRANSFERASE. Eliza A. Jacob, Jeanhee Chung, Austin T. Wray, &
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, i.e. this methylation is essential for gene expression. The non-methylated cap structure-RNA was produced by in vitro transcription with T7-RNA polymerase. This RNA was purified by gel electrophoresis and different size fractions were recovered. By isolating the lower molecular weight non-methylated capped RNA, we increased the overall yield by about 5 fold. The enzyme that methylates the N-7 position, Guanine-7-methyltransferase, has been expressed as a His-tag protein in E. coli. The addition of histidines at the N-terminus allows the enzyme to be purified on a Nickel column. The full length enzyme, 476 amino acids long, is about 80% pure after the nickel column. To further purify the enzyme, a positively charged ion-exchange column (Mono Q-Sepharose) was used. The eluant from the Nickel column was applied to the Mono-Q column 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 and methyltransferase activity were observed which corresponded to about 90% homodimer and 10% monomer. We plan to study the deletion mutation (minus 120 amino acids) to see if the N-terminal region plays a role in subunit formation.

STATISTICALLY DESIGNED EXPERIMENTS: TOOLS FOR EDUCATION AND THE EXAMINATION OF REGIOCHEMISTRY OF ELECTROPHILIC AROMATIC SUBSTITUTIONS. J. A. Mann, Dept.of Chem./Physics and BES, Longwood University, Farmville, VA & G. P. Lutz, Prince Edwards County High School. Statistically designed experiments were developed and executed in order to determine the effects of several variables on the regiochemistry of electrophilic aromatic substitution (EAS) reactions. One experiment employed the electrophilic aromatic bromination of phenol, and indicated that temperature and concentration had statistically insignificant effects on the product composition of the reaction, while the mole ratio of bromine to phenol and percent water content of the solvent had significant effects at the 95% confidence level (i.e. \( = 0.05 \)). Another experiment investigated the Friedel-Crafts acylation of three butylbenzene isomers, and showed that temperature and reaction time had insignificant influences on product composition, while solvent dielectric constant and substrate substitution pattern had a significant influence (\( = 0.05 \)). Together these experiments suggest that chemometric methods may be useful in investigating even well understood reactions. The Friedel-Crafts acylation experiments also represent the initial stages in the development of a quantitative method for describing steric effects. In addition, a laboratory exercise was designed and incorporated into Longwood University’s Organic Chemistry Laboratory II course. The implementation of the exercise was evaluated and suggested that students are receptive to new teaching styles.
SYNTHESSES AND SOME SPECTRAL PROPERTIES OF NON-LINEAR OPTICAL CHROMOPHORES WITH 1:1 TO 1:3 RATIOS OF ELECTRON-DONATING:ELECTRON-WITHDRAWING GROUPS PER MOLECULE.

Godson C. Nwokogu, Dept. of Chem., Hampton University, Hampton, VA 23668.

The magnitude of the second order hyperpolarizability constant, for chromophores consisting of an electron-donating group connected to an electron-withdrawing group through a conjugated polyene bridge are usually optimized through structural features such as the match between donor and acceptor groups or the length of the polyene bridge. In this project, the effect of varying the ratio of electron-donating-to-electron withdrawing groups is investigated. Starting from tris-(p-bromophenyl)amine 1, one, two or three cyclohexenone moieties have substituted the appropriate number of bromines to produce corresponding mono-, bis- or tris-[p-(cyclohexen-1-on-3-yl)phenyl]amines 2. These cyclohexenone derivatives were successfully condensed with thiobarbituric acid in CCl₄ in high yields to produce the corresponding chromophores 3 with the amino-group donor and one, two or three thiobarbituric acid residues as electron-withdrawing groups per molecule. Preliminary absorption and emission spectra indicate a significant red shift from 1:1 to 1:2 but a minimal red shift from 1:2 to 1:3 chromophores. The substances show amorphous character and thermal stability well above 300°C.

DEVELOPMENT OF GC-MS AND CHEMOMETRIC METHODS FOR THE ANALYSIS OF ACCELERANTS IN ARSON CASES, Boone M. Prentice, Melissa C. Rhoten, and Sarah E. G. Porter, Dept. of Chem./Physics, Longwood University, Farmville, VA

There is an interest in the forensic community in identifying accelerants by their gas chromatography-mass spectrometry (GC-MS) profile. In this work, samples of accelerants were analyzed by GC-MS and compared using chemometric analysis. Four analytical standards (unweathered gasoline, diesel fuel, kerosene, and mineral spirits) were purchased from Restek®, and regular, mid-grade, and premium unleaded gasoline were purchased at the local Valero gas station. GC-MS analysis was performed on a 30m x 0.25 mm x 0.25 µm VF-1ms capillary column using a Varian GC-MS system with the following conditions: split injection (3:1) at 250 °C; temperature programmed from 50 (2.5 min isothermal) to 300 (5.83 min isothermal) at 15°C/min; helium carrier gas at a flow rate of 1 mL/min. The GC-MS chromatograms were assembled into a single data set and compared using principal component analysis. A pattern recognition algorithm was developed based on the variance-covariance matrix of the data set. Replicate analyses of the analytical standards constituted a set of training data to which the purchased gasoline samples could be compared.
STRENGTHENING GLOBAL COOPERATION IN SCIENCE AND SCIENTIFIC RESEARCH, Isai T. Urasa, Department of Chemistry, Hampton University, Hampton, VA 23668. International collaborations in science and scientific research can play a vital role in promoting global economic growth, improving human health, building human capacity, and protecting the environment. To a large extent, such collaborations cannot be sustained in the absence of strong international higher education partnerships that support the exchange of students and scholars. This paper will provide an overview of current practices of international higher education, highlighting the challenges and opportunities that exist for American higher education institutions.

ENDOCRINE DISRUPTORS (EDCs). WHO ARE THEY, WHAT ARE THEY AND WHERE ARE THEY? Roy L. Williams, Professor Emeritus, Dept. of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA 23539-0126. The US public has suddenly become aware of the presence of a wide variety of organic chemicals in many drinking water utilities throughout the country. These chemicals are now known as endocrine disruptors (EDCs) and pharmaceuticals and personal care products (PPCPs). EDCs are known to be estrogen agonists and may affect hormonal activity and sexual development in a wide variety of aquatic life. There presence is alarming due to their potential health effects and the risk of long term exposure is currently a major concern to the drinking water industry and the federal government. To date there are no federal regulations governing these compounds and most conventional drinking water treatment schemes are not effective for the removal of the EDCs and PPCPs. The major source of these EDCs and PPCPs appears to be from inadequately treated waste water effluents that impact certain raw water sources. This paper will provide an overview of the nature and problems associated with this new class of drinking water contaminants.

Computer Science

DESIGN AND SIMULATION OF SMART EMERGENCY SERVICE VEHICLES IN VEHICULAR AD HOC NETWORKS. Syed R. Rizvi1, Stephan Olariu1, Mona E. Rizvi2 & Michele C. Weigle1, 1Dept. of Computer Science, Old Dominion University, Norfolk, VA 23529 and 2Dept. of Computer Science, Norfolk State University, Norfolk, VA 23504. Vehicular Ad Hoc Networks (VANETs) have recently been proposed as one of the promising ad-hoc networking techniques that can be used to provide a safe and enjoyable driving experience. Vehicles on the road form VANETs, whose main purpose is to exchange messages related to traffic safety and other security-related events. VANETs have unique requirements with respect to applications, communication types, self-organization and many other issues. With multi-hop communication, each vehicle can benefit from the locally sensed data of surrounding vehicles or from multi-hop access opportunities. This paper provides the design approach, analysis and simulation results for the recently
proposed novel chaos reducing information dissemination approach for spatio-temporal traffic information related to first responders and evacuation scenarios using VANETs. Our VANET-based design can be used to enhance the effectiveness of existing evacuation plans and to reduce chaos and confusion among victims and first. Due to the prohibitive cost of deploying and implementing such a system in real world, most research in VANET-based systems relies on simulations for evaluation. We use a realistic mobility as well as traffic model. Simulation results show that our approach works efficiently without fully relying on any message relaying infrastructure.

SELF SIMILARITY AND COMPUTER SECURITY. Yen-Hung Hu, Department of Computer Science, Hampton University, Hampton, VA 23668. Self similar nature has been seen in some computer and network activities and several literatures have demonstrates that it could be adopted to enhance the identification and verification of computer and network anomalies. In this paper, we study the mathematic and statistical characteristics of self similarity and survey and investigate the most famous computer and network activities to realize which of them shows self similar nature. To extend our understanding, we assess and examine the existing approaches that include self similarity in their algorithms and analyze performance of them. Meanwhile, we depict a novel framework that integrates several modules, where each of them could be arranged to detect anomalies of a specific computer and network. To evaluate our design, performance study of our framework has been conducted through various systematic computer and network simulations.

A SPARSE LINEAR SOLVER. Stephen V. Providence, Department of Computer Science, Hampton University, Hampton Virginia 23668. This research is centered on the special case of a sparse Cauchy-like matrix by dense vector product computation. Projects of this kind are of importance to researchers in signal processing and computational mathematics. We consider Trummer's highly important problem and the classical problems of polynomial interpolation (p.i.) and evaluation (p.e.) For all problems we substantially improve the known algorithms by devising nontrivial transformations of the associated structured matrices. The transformations reduce p.i. and p.e. to application of FFT, DCT or DST and to solving Trummer's problem in the special case where the solution by Rokhlin's algorithm is highly efficient. Our solution of p.e. and p.i. is in turn extended to efficient solution of Trummer's general problem. The resulting numerically stable algorithm solves all the 3 problems (that is, p.i., p.e. and Trummer's) at the cost $O(n \log n)$, versus the bounds of order $n \log^2 n$ supported by the known numerically unstable algorithms, whereas the bound $O(n \log n)$ was known for Trummer's problem only under a substantial restriction on the input class. The reader is referred to [PSLT93], [PZHY97] and [PACLS98] on some preceding work
on the structured matrix approach to p.e./p.i. and Trummer's problems exploiting Rokhlin's algorithm and the transformations of the problems into each other.

Education

DOES STUDENT PREPARATION FOR LECTURES AFFECT TEST SCORES?
Lisa S. Webb, Christopher Newport University, Department of Biology, Chemistry and Environmental Science, 1 University Place, Newport News VA 23606. It is commonly acknowledged among faculty and students that the average college student does not prepare for lectures. This lack of preparedness leads to instructor frustration due to a (real or) perceived suboptimal utilization of class time and student frustration due to the lack of familiarity with the background concepts and vocabulary presented in the lecture. I hypothesize that student learning (as measured by scores on lecture exams) would increase if students would prepare for lectures. In order to test this hypothesis, I gave students written assignments on the learning objectives that would be covered in the course. Students would need to either read the textbook or utilize some other source to obtain the information necessary to complete the assignments, which were collected immediately before the material was covered in class. I collected data from 495 students taking a junior level introductory Cellular Biology course over the last four years. During that time, the course was taught using the same set of learning objectives and in the same organizational format (e.g. two or three lecture exams, several in-class quizzes, a semester exam, a weekly four-hour lab). Data, in the form of pooled exam score averages and variances from the control group (n = 278) and the experimental group (n = 217) were analyzed using a two-tailed t-test, and were determined to be not significantly different (p = 0.448422). This indicates that preparation for lecture does NOT significantly affect test scores.

CONFIGURATION OF A LARGE CLOUD CHAMBER FOR STUDENT RESEARCH AND MUSEUM DEMONSTRATIONS IN PARTICLE PHYSICS AND CHEMISTRY. Nicole K. MacCracken & David B. Hagan, George Mason Univ. and Science Museum of Virginia, Richmond, VA. The cloud chamber at the Science Museum of Virginia is an excellent resource for student research. It allows natural background radiation to become visible in the supersaturated isopropyl alcohol vapor that forms above the chilled liquid alcohol at the base of the observation chamber. The cloud track of each subatomic particle is distinct, allowing for easy identification of the particle. There are three main sources for the natural radiation seen in the cloud chamber: Solar, galactic, and terrestrial. The solar source of radiation comes from the charged cosmic wind, and the terrestrial source is a result of the natural radioactive decay of radon and other molecules found in the earth. The galactic source of natural radiation is resultant of cosmic rays, extremely energetic particles from outside our solar system. These particles undergo extensive decay in our atmosphere, producing protons, neutrons, electrons, positrons, and high
energy muons. All of these particles are visible and available for study in the cloud chamber. Future student research can be enhanced by the addition of an electromagnet to the cloud chamber. Studying low energy particles' effect under the electromagnet force can allow for an individual particle's energy and source to be found algebraically. The possibilities for student research with the cloud chamber are numerous, as topics in chemistry, physics, astronomy, and earth science are just a few that can be explored with the Science Museum of Virginia's cloud chamber.

THE VALUE OF HISTORY IN THE MATHEMATICS CLASSROOM. W. Michael Gentry, Dept. of Mathematics, Mary Baldwin College, Staunton, VA. 24401. Historical problems, defined as questions originating hundreds of years ago, can be understood, appreciated and explored in today’s classrooms. The purpose of this paper is to demonstrate that the use of historical problems illustrates the evolution of heuristic processes.

AN EVALUATION OF TEACHER PLANNING FOR A MUSEUM FIELD TRIP: ARE LEARNING OBJECTIVES ALIGNED WITH MUSEUM PROGRAMS? Sarah F. Howell & Eugene G. Maurakis, Curry School of Education, Univ. of Virginia, Science Museum of Virginia, Richmond, VA. With some of the pressures facing today’s public schools, the inclusion of out-of-classroom science learning experiences with the traditional science curriculum has been challenged. To better improve museum programming in order to attract more school groups and educational field trips, I examined how well aligned the objectives of the Science Museum of Virginia (SMV) were to the objectives of the teachers using their programs, including SMV’s Museum Learning Links. I interviewed 3 teachers to find out what activities they had planned and what objectives and goals they intended the students to meet while at the museum. Similarities and common themes among the teachers were compared to the mission statements and exhibit criteria of the SMV in order to see where there were commonalities and/or mismatched goals. It seemed that the teachers had broader, more “big picture” goals for the students, as opposed to specific content objectives and none of the teachers had heard of the Museum Learning Links program. This leads me to believe that there needs to be more communication between the teachers and museum about the content of the exhibits, in order to connect that content with the students in an appropriate way.

Environmental Science

TRENDS IN OZONE-INDUCED FOLIAR INJURY ACROSS VIRGINIA, 1997-2006. Anita K. Rose, US Forest Service, Forest Inventory and Analysis, Knoxville TN 37919. Ozone (O₃), significant air pollutant affecting vegetation, can occur at
concentrations that cause visible foliar injury on a number of plant species. The
USDA Forest Service tracks foliar injury with the goal of determining where
negative impacts to forest trees may be occurring across the landscape. \( O_3 \) injury
was tallied on open areas (biosites), at least 1 acre in size. At each biosite 30 plants
of at least 2 indicator species were inspected for ozone injury. A plot-level foliar
injury index (biosite index) was derived from the amount and severity of injury
recorded at each biosite. Between 1997 and 2006, 20,685 plants across Virginia
were evaluated for ozone injury. The highest occurrence of plant injury was in 1997
and 1998. While 1997 had the 2nd highest % of plants with injury, the average
biosite index was highest in 1998 and 2000. Biosites with moderate to severe injury
occurred in 5 of the 10 years. However, since 2001, injury occurred on < 5% of
plants, and the average biosite was <5. In addition, little or no injury was detected
in 2004 through 2006. When it did occur, ozone-induced foliar injury was often
most prevalent on the Coastal Plain. Except for 2003, these field assessments
indicate that between 2002 and 2006 very little ozone foliar injury occurred across
the state of Virginia. This was in contrast to the previous 5 years (1997-2001)
where between 7 percent and 38 percent of biosites in every year, except for 1999,
exhibited moderate to severe ozone injury. Hopefully, this trend of decreasing or
very little ozone-induced injury will continue in the future. The continued
collection of this type of data will enhance our ability to determine the impacts, if
any, of ozone injury occurring across the US.

A PRELIMINARY STUDY OF ISONYCHIA MAYFLY (EPHEMEROPTERA:
ISONYCHILDAE) NYMPHS AS STANDARD TOXICITY TEST ORGANISMS.
B.S. Echols1, D.S. Cherry1, R. J. Currie2, M.K. Chanov1 & A.S. Carlson1,
1Department of Biological Sciences, Virginia Tech, Blacksburg VA 24061 and
2Toxicology and Environmental Research and Consulting, The Dow Chemical
Company, Midland MI 48674. Benthic macroinvertebrates or aquatic insects are
widely used in field studies to assess the environmental effects of pollution. Insects
belonging to the order Ephemeroptera (mayflies) are well documented as sensitive
indicators of water quality; however, these organisms have been rarely used in
laboratory bioassays. The purpose of this project was to conduct a series of
laboratory toxicity tests with a single mayfly species (Isonychia spp.) to assess the
feasibility of using this species as a standard bioassay organism. Isonychia nymphs
were tested in both a coal processing effluent and a reference toxicant (NaCl). No
Observed Effect Concentration (NOEC) values were consistently lower for
Isonychia survivorship compared to the much more sensitive reproductive endpoint
for Ceriodaphnia dubia. However, C. dubia were more sensitive to the NaCl after a
seven-day chronic exposure than Isonychia. Compared to other standard test
organisms endorsed by the USEPA, Isonychia are second behind C. dubia in
sensitivity to NaCl, while NOECs for Daphnia magna, Pimephales promelas
(fathead minnow) and Hyalella azteca (amphipod) are at least two-fold higher.
Results of these tests indicate that Isonychia may be a suitable test organism for
determining effluent toxicity; however more research must be done to support these
findings.
MONITORING THE PROGRESS OF STORM WATER MANAGEMENT PONDS OF CENTRAL PARK AND AN OFF-SITE WETLAND MITIGATION PROJECT. K. Oldham, L. Neese, L. Maxfield & M. Bass, Department of Earth and Environmental Sciences, University of Mary Washington, Fredericksburg VA 22401. The Silver Company built the commercial Central Park, in an area with six acres of wetland that required mitigation with two other areas; benches around storm water management ponds that are in Central Park itself and an off-site in Spotsylvania County. The constructed wetland was created adjacent to a natural wetland. In 2002, construction of a housing development began on top of a hill next to the off-site mitigated wetland. Monitoring involved water analysis for dissolved oxygen, temperature, conductivity, pH, nitrates, phosphates, alkalinity, and total hardness in both locations. Within the off-site wetland, a survey of woody stems was done to assess the progress of the site towards a forested wetland. A comprehensive list of woody and herbaceous species was generated showing a slight increase from last year, indicating succession toward a healthy wetland ecosystem. The water analyses results showed no unusual levels of compounds tested were found in either the SMPs or the constructed wetlands and were well within required limits. A density of 565 woody stems per acre was calculated and is well above VDEQ's requirement of 400 woody stems per acre for a forested wetland. Soil coring showed hydric soil throughout the constructed wetland and additionally areas that were originally designated as upland. This wetland mitigation site has exhibited success and will be monitored in the future.

THE ECOTOXICOLOGICAL RECOVERY OF THE BLACK CREEK WATERSHED AFTER REMEDIATION OF ACID MINE DRAINAGE SEEPS. M.K. Chanov, B.S. Echols, R. Currie, D.S. Cherry, C.E. Zipper, 1Department of Biological Sciences, VPI and SU, 2The Dow Chemical Company, 1803 Building, Midland, MI 48674, and 3Department of Crop and Soil Environmental Science, VPI and SU. Acid mine drainage (AMD) impacts the coal mining areas throughout the United States. The Black Creek Watershed (Wise County, VA), a subwatershed of the Powell River, has been affected by extensive AMD seeps. The Black Ck subwatershed has undergone extensive remaining for coal with active remediation of the Abandoned Mine land (AML) and AMD seeps as part of the mining activities. New holding ponds were developed to encourage settling of precipitates from some of the seeps that remain. The Black Ck subwatershed has had some of the toxic seeps remediated using and open water wetland system that allows for increased retention time to allow for toxic elements to settle out. However, some of the toxic seeps present in the 1990s are still there today and continue to exert effects on the subwatershed. The conditions in the upper mainstream have improved with measured pH and conductivity. However, lower mainstem sites had considerably higher conductivity values due to the active mining still being conducted in this watershed. Aluminum and iron (Al and Fe) in the water column was relatively high in the unremediated seeps, but were at much lower levels in the mainstream. Al and Fe in the sediments throughout the subwatershed were elevated when compared to un-impacted sites. Laboratory and field tests showed that the unremediated seeps
remain acutely toxic, but that the effects of this acute toxicity are not measured in the mainstream. At the lowest sites in Black Ck, a toxicity issue was discovered with *in situ* Asian clams because clams at these lower sites died and was confirmed with laboratory sediment tests with *D. magna*. These parameters indicate that since remediation there has been some increase quality in this subwatershed, however, significant ecotoxicological problems still remain.

**CAN SEA-SALT AEROSOLS SERVE AS A SINK FOR GASEOUS MERCURY?**
Matthew C. Richardson, Brianna M. Strain & Elizabeth G. Malcolm, Department of Earth and Environmental Sciences, Virginia Wesleyan College, Norfolk VA 23502. Today mercury (Hg) is a pollutant of great concern due to its widespread contamination and neurotoxic effects. An important source of this Hg in aquatic ecosystems is atmospheric deposition. A thorough understanding of the atmospheric chemistry of Hg is vital for predicting the fate of these anthropogenic Hg emissions. This ongoing study investigates whether sea salt aerosol may be an important sink for gaseous mercury by adsorbing either reactive gaseous mercury (RGM) or elemental gaseous mercury (Hg$^0$). In phase one of this study ambient air in Norfolk, VA was passed over surfaces coated with NaCl. For phase two of this study a laboratory manifold was designed and tested in which NaCl and seawater coated surfaces are exposed to controlled concentrations of an RGM compound, HgCl$_2$. In phase one, 40-70\% of RGM and < 0.1\% of Hg$^0$ were absorbed by the NaCl surface. These initial results support the hypothesis that sea-salt aerosols can scavenge RGM, potentially increasing deposition of this form of Hg in coastal environments.

**Medical Science**

5-HT$_3$ RECEPTOR AGONISTS AS ANALGESIC ADJUVANTS. Genevieve W. Sirles & Malgorzata Dukat, Department of Medicinal Chemistry, School of Pharmacy, Virginia Commonwealth University, Richmond, VA 23298-0540. *meta*-Chlorophenylguanidine (MD-354) was identified as an analgesia-enhancing agent that seems to act both by a 5-HT$_3$ and $\alpha_{\text{NON-2A}}$-adrenoceptor mechanism (i.e. MD-354 produces a biphasic response). To further evaluate the role of the underlying 5-HT$_3$ mechanism, SR 57227A (4-amino-(6-chloro-2-pyridiyl)-1 piperidine), a high affinity, selective 5-HT$_3$ receptors agonist, with both peripheral and central actions, was examined in the mouse tail-flick, hot-plate and locomotor activity assay. SR 57227A (0.3-10.0 mg/kg) lacked antinociceptive effects in the mouse tail-flick assay when administered either alone or in combination with ED$_{50}$ dose of clonidine. Interestingly, significant antinociception was observed at a high dose of SR 57227A (30.0 mg/kg; $P<0.01$) in the mouse hot-plate assay. The lower doses (0.3-10.0 mg/kg) of SR 57227A neither potentiated nor attenuated the antinociceptive effect of ED$_{50}$ dose of clonidine. SR 57227A had no effect on mouse motor activity. It might be concluded that a 5-HT$_3$ receptor mechanism is involved in the
ANTINOCICEPTIVE ACTIONS OF TDIQ – AN ISOBIOGRAPHIC ANALYSIS. Genevieve W. Sirles, Jessica Worsham, & Malgorzata Dukat, Department of Medicinal Chemistry, School of Pharmacy, Virginia Commonwealth University, Richmond, VA 23298-0540. TDIQ (5,6,7,8-tetrahydro-1,3-dioxolono-[4,5-g]isoquinoline), an agent that binds to all three $\alpha_2$-adrenoceptors (ARs), was shown to potentiate the analgesic effect of clonidine (an $\alpha_2$-AR agonist) in the mouse tail-flick assay. The analgesia-potentiation effect appears to be selective because TDIQ had no effect on clonidine’s hypolocomotion. In the present investigation mechanistic studies with $\alpha_2$-AR antagonists: BRL-44408 ($\alpha_{2A}$), imiloxan ($\alpha_{2B/2C}$), and ARC-239 ($\alpha_{2C}$), showed that the potentiation effect of clonidine by TDIQ is complex and involves more than one subtype of $\alpha_2$-AR. All three antagonists blocked the analgesia-potentiation effect of TDIQ. Another purpose of this study was to determine if the nature of the potentiation effect was additive or supra-additive (i.e. synergistic). To evaluate synergism, the experimental ED$_{50_{mix}}$ of TDIQ/clonidine combinations (fixed-ratio) were compared to the theoretical ED$_{50_{add}}$ of a simply additive mixture having the same proportions. The isobolographic analyses, using a 3:1 (ED$_{50_{add}}$ = 1.76 mg/kg; ED$_{50_{mix}}$ = 0.79 mg/kg) and 12:1 (ED$_{50_{add}}$ = 5.72 mg/kg; ED$_{50_{mix}}$ = 1.64 mg/kg) fixed-ratio of TDIQ/clonidine dose, showed that these two combinations behaved synergistically; that is, the combinations had an exaggerated effect compared to the effect produced by the sum of each drug administered alone. (Supported by: The Jeffress Memorial Trust RG-J-778).

BINDING MODE(S) OF ARYLGUANIDINES AT IONOTROPIC h5-HT$_{3A}$ RECEPTORS. Katie E. Ownby, Justin Elenewski & Malgorzata Dukat, Department of Medicinal Chemistry, Virginia Commonwealth University, Richmond VA 23298. Within the last decade we have shown that several arylguanidines and arylbiguanides bind with high affinity at 5-HT$_3$ receptors. Through mutagenesis studies, amino acids involved in the binding of serotonin and a few 5-HT$_3$ receptor antagonists have been elucidated. However, the binding modes of arylguanidines have not yet been investigated. To identify possible binding modes of various arylguanidines, molecular modeling was employed. Fifty homology models of the h5-HT$_{3A}$ receptor were constructed using several other ligand-gated ion-channels for alignment of the h5-HT$_{3A}$ receptor sequence to the binding domain of the nicotinic acetylcholine receptor (nAChR). Sybyl and Modeller were used to generate the models based on a template of the crystal structures of the binding domain of the nAChR (PDB 2qcl) and the acetylcholine binding protein (PDB 1i9b). The models were validated by docking a 5-HT$_3$ receptor agonist, serotonin, and 5-HT$_3$ receptor antagonist, granisetron, using GOLD or AutoDock programs. The docking results revealed two binding modes; one for agonists and another for antagonists. meta-Chlorophenylguanidine (MD-354), a 5-HT$_3$ receptor partial agonist, was docked and
found to utilize a binding mode similar to serotonin. Conformationally constrained analogs of MD-354 were synthesized and their binding mode was evaluated. (Supported by: The Jeffress Memorial Trust RG-J-778).

IN SEARCH OF QUANTITATIVE TRAIT LOCI: MORPHOMETRIC ANALYSIS OF RECOMBINANT INBRED STRAINS OF MICE. Lisa S. Webb, Christopher Newport University, Department of Biology, Chemistry and Environmental Science, 1 University Place, Newport News VA 23606 & Brynn H. Voy, Biosciences Division, Mammalian Genetics and Genomics Section, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831. Recombinant Inbred mouse strain panels enable both genetic association studies and the integration of multi-system, multi-investigator datasets due to their stable genetic architecture. As such, RI strains are a valuable model for the study of complex traits. Our long term goal is to dissect the genetic interactions that control adipose tissue mass due to its relationship with many disease processes, such as Type 2 diabetes. As a starting point, we collected and analyzed morphometric and phenotypic data on 41 strains of BXD (C57BL/6J X DBN2J) RI mice, a panel selected for its size and its wealth of existing multiscale data for other traits. Fasting plasma glucose levels, body weight, organ (heart, kidney, liver, thymus, spleen) and fat pad weights were measured from adult male and female mice, 3-5 mice per strain. Adiposity index was calculated to reflect overall fatness. Existing genotype data and analytical tools resident within WebQTL were used to screen for regions of the genome containing polymorphisms that co-segregated with each trait. Several genomic regions of interest were identified, particularly for adiposity. Parallel analysis of relevant molecular traits is underway. Genomic regions of interest and potential candidate genes within those regions will be presented. This study was funded in part by the U.S. Department of Energy, Office of Science (FaST Program) and a Dean’s Office Grant from Christopher Newport University.

ECSTASY AND THE HEART: INTRACELLULAR AND FUNCTIONAL IMPACT. D. A. Tiangco, S. Halcomb, F. A. Lattanzio, Jr., S. J. Beebe & B. Y. Hargrave, 1Department of Biological Sciences, Old Dominion University, Norfolk VA 23529 and 2Department of Physiological Sciences, Eastern Virginia Medical School, Norfolk VA 23501. 3,4-Methylenedioxymethamphetamine (MDMA) is a popular and illicit psychoactive drug. The effects of this compound on the heart have not been fully described. The current study used direct intraventricular transduction to measure acute functional responses to MDMA in the intact rabbit. Confocal microscopy and enzyme-linked immunosorbent assay (ELISA) was used to measure intracellular Ca\(^{2+}\) and nuclear factor-kappa B (NF-\kappa B) activation respectively in cultured rat cardiac myocytes (H9c2) exposed to MDMA. In the rabbit, MDMA (2 mg/kg) caused a significant increase in heart rate and a significant decrease in duration of cardiac cycle. Inhibition of nitric oxide synthase by administration of L-NAME, aggravated the functional abnormalities induced by
MDMA. Exposure of H9c2 cells to 1.0 mM MDMA caused increased intracellular \( \text{Ca}^{2+} \) within 5 minutes. Exposure of H9c2 cells to 1.0 mM MDMA for 6 hours and 2.0 \( \mu \text{M} \) MDMA for 12 hours caused increased nuclear localization of NF-kB. Together, the current results suggest that MDMA may be acutely detrimental to heart function. In addition, this drug may be directly cardiotoxic in a temporal and dose-dependent manner through its ability to alter \( \text{Ca}^{2+} \) homeostasis and activate the NF-kB response.


Comparative Molecular Field Analysis (CoMFA) was used to elucidate properties that contribute to the binding affinities of a series of phenylalkylamines at r5-HT\(_{2A}\) and h5-HT\(_{2A}\) receptors and to generate models capable of predicting affinities of these compounds based on their structure alone. A series of 31 and 25 phenylalkylamines with confirmed agonist properties at r5-HT\(_{2A}\) and h5-HT\(_{2A}\) receptors, respectively, was used to generate models. Computational energy minimizations were performed on the constrained high-affinity agonist, 1-(4-bromo-2,3,6,7-tetrahydrofurao[2,3-f]benzofuran-8-yl)propan-2-amine using SYBYL 7.3. From this structural template the remainder of both series were constructed and minimized in the same way. Semi-emperical methods were then used to generate charges for each molecule. Both series of compounds were aligned using the minimized structure of 1-(4-bromo-2,5-dimethoxyphenyl)propan-2-amine (DOB) as a template. Models generated a predictive \( q^2 = 0.696 \) and a non-cross-validated \( R^2 = 0.970 \) for the r5-HT\(_{2A}\) model and \( q^2 = 0.690 \) and \( R^2 = 0.981 \) for the h5-HT\(_{2A}\) model. Structural features of this series have been highlighted as points for modification to increase affinities; with ongoing models of 5-HT\(_{2B}\) and 5-HT\(_{2C}\) subtypes, comparisons could be made in order to exploit features to design selective agents. This is beneficial in that certain of these agents are drugs of abuse and some display toxicity. [Supported in part, by the Lowenthal Endowment]

EFFECT OF ANTICANCER DRUG TAMOXIFEN ON SIGNAL TRANSDUCTION IN HUMAN PLATELETS. Vidhi P. Shah, & Yuliya Dobrydneva, Dept. of Physiological Sciences, Eastern Virginia Medical School, Norfolk VA 23501.

Intro: Tamoxifen (TAM) is widely used for the prevention and treatment of breast cancer. However, TAM also increases the incidence of thrombosis. Since excessive stimulation of platelets can lead to thrombosis, we investigated the mechanisms by which TAM promotes platelet activation. Methods: aggregation, lucigenin chemiluminescence, PAC-1 detection using flow cytometry, \([\text{Ca}^{2+}]_i\) measurements with SPEX ACRM spectrofluorometer. Results: We confirmed that TAM increases platelet aggregation. TAM causes expression of the PAC-1 antibody ligand, a marker of platelet activation. TAM generates reactive
oxygen species/superoxide (ROS/SO) in human platelets. NADPH oxidase is one of the sources of ROS/SO in platelets exposed to TAM. The NADPH oxidase inhibitor, apocynin, inhibited TAM ability to increase \([\text{Ca}^{2+}]_i\) while its analog 3'-Hydroxy-4'-methoxyacetophenone had small inhibitory effect on TAM action. TAM activates PI3 kinase as the two PI3 kinase inhibitors wortmanin and LY294002 inhibited TAM-induced \([\text{Ca}^{2+}]_i\) elevation. Conclusions: TAM activates platelets and increases platelet aggregation. TAM activates both PI3 kinase and NADPH oxidase. NADPH oxidase is involved in the production of ROS/SO and increases in \([\text{Ca}^{2+}]_i\). However, the pathway that connects PI3 kinase to NADPH oxidase is still unknown and will be investigated in our future experiments. Acknowledgements: Commonwealth Health Research Board, American Cancer Research and Prevention Foundation, and American Heart Association, National affiliate.

INTERACTION OF THE SIGMA2 RECEPTOR LIGAND PB28 WITH THE HUMAN NUCLEOSOME. C. Abate, J. Elenewski, & R. A. Glennon, Department of Medicinal Chemistry, Virginia Commonwealth University, Richmond VA 23298.

Sigma (σ) receptors, classified into σ1 and σ2 subtypes, are endoplasmic binding sites involved in neuroprotective and neuroregulative functions, and are overexpressed in many tumor cell lines. Nevertheless, the physiological function and structure of these receptors have yet to be clarified. In an attempt to isolate the σ2 receptor, we functionalized the σ2-selective ligand PB28 and coupled it to a stationary phase, through which lysed human neuroblastoma cells were eluted. The purified proteins were analyzed using MALDI-MS and identified as histones (H1, H1.2, H2A.5, H2B, H3.3A). Several homology models of each monomer (H1, H2A, H2B, H3), dimer (H2AB, H34), and octamer (nucleosome) were generated through MODELLER, using the crystal structure of the chicken nucleosome as a template. The resulting population of models was minimized using NAMD, and both enantiomers of PB28 were docked to each of these models via AUTODOCK. Analysis of the docking studies reveals optimal intermolecular interactions between PB28 and the H2AB dimer. In particular, the cationic piperazine moiety in PB28 is observed to interact with a conserved (D/E)XXE motif located on the second helical segments of the H2A and H2B subunits, with strongest interactions seen on the H2B face of the H2AB dimer. Furthermore, the aromatic portion of PB28 preferentially docks in a hydrophobic region between H2A and H2B.

DOCKING AND FUNCTIONAL INTERACTIONS OF AGONISTS AND ANTAGONISTS WITH A h5-HT6 RECEPTOR MODEL. J. E. Elenewski & R. A. Glennon, Department of Medicinal Chemistry, Virginia Commonwealth University, Richmond VA 23298. Agonist activation of monoamine G-protein coupled receptors is believed to occur through an aromatic motif in TM6 (F6.44, W6.48, F6.51, F6.52) lining the ligand binding pocket opposite the TM3 aspartate (D3.32). Biophysical data indicate that this conformational switch initiates a rigid body rotation of TM6 about a conserved proline kink (P6.50), resulting in a relative
intracellular translocation of TM3 and TM6 and hence a change in the fold of intracellular G–protein binding domains. These data have been augmented through the recent publication of two XRD structures of the human β2–adrenoceptor as well as the XRD structure of a β2–adrenoceptor / T4-lysozyme chimera. In order to reevaluate the activation process in light of these structures, and to assess their utility for homology modeling, models of the h5–HT6 receptor have been constructed (MODELLER) using a photoactivated bovine opsin and the chimeric human β2–adrenoceptor as templates. Ab initio parameterization of ligands (RHF/DFT/B3LYP/6-31G(d), GAMESS), followed by automated ligand docking (AUTODOCK) and molecular dynamics simulation (NAMD), have been performed in order to elucidate the binding modes of several 5–HT6 receptor agonists and N1-(benzenesulfonyl)tryptamine antagonists. Differences are noted in the ligand binding region between bovine opsin and β2–adrenoceptor–based models, as well as in the binding modes of agonists and antagonists, indicating that these structures are not equivalent as templates for homology modeling.

THE VASCULAR RESPONSE TO ALPHA-1 ADRENERGIC STIMULATION DIFFERS IN HIGH AND LOW WEIGHT CHICKENS: IMPLICATIONS FOR THE DEVELOPMENT OF A NON-MAMMALIAN GENDER DIFFERENTIATING MODEL OF THE METABOLIC SYNDROME. Oluyinka Akinbinu1, Paul B. Siegel2, Arben Santo1, Ronald M. Lewis2, Hongbo Zhang2, Mark A. Cline3 & Richard P. Wyeth1, 1Edward Via Virginia College of Osteopathic Medicine, Blacksburg, VA 24060, 2Virginia Polytechnic Institute and State University, Blacksburg, VA 24060, 3Radford University, Radford, VA 24142. While gender differences in blood pressure are appreciated, how these relate to obesity is not well understood. The current study asks if this chicken model mimics the metabolic syndrome in women compared to men in this regard. Age matched, chickens were used; high weight females (HWF), high weight males (HWM); low weight females (LWF) and low weight males (LWM). α1 adrenergic vasomotor activity was found with serial phenylephrine addition to isolated aortas, prior to and after g-nitro-L-Arginine-Methyl Ester (L-NAME). Efficacy (Tmax), developed from prior to after L-NAME was different only in LWF (p<0.007). Potency (EC50) changes, prior and following LNAME approached significance in HWF (p<0.06). No significant changes in Tmax or EC50 were noted in other groups. A significant difference was noted in EC50 between LWF and LWM (p< 0.03) prior to L-NAME while HWM and HWF showed a tendency (p<0.07) prior to L-NAME and HWF showed a lower EC50 compared to LWF (p<0.007). Following L-NAME, LWF showed greater Tmax compared to LWM (p<0.02). Tmax was also different (p<0.05) when LWF and HWF were compared. This study suggests this model is suitable for evaluating gender effects on hypertension in the metabolic syndrome.

Departments of Physiology, Anatomy, Pathology, Edward Via Virginia College of Osteopathic Medicine, Blacksburg, VA 24060, Department of Pharmacology, Texas University, Austin, TX 78712, Virginia Polytechnic Institute and State University, Blacksburg, VA 24060 and Raabe College of Pharmacy, Ohio Northern University, Ada, OH 45810. MDMA-induced hyperthermia (HyT) and hypertension may be lethal. No specific treatment for MDMA-induced HyT and/or hypertension exists but women have less incidence of HyT. Gonadectomized female (estrogen) and male (testosterone) rats were treated for 10 days and then given saline or MDMA, core body temperatures taken, rats sacrificed and aortas constricted, in vitro, with phenylephrine, with or without \( \text{g-nitro-L-Arginine-Methyl Ester (L-NAME)} \). Norepinephrine (NE) from venous plasma, and uncoupling protein 3 (UCP3), from the gastrocnemius, were measured. Only males developed HyT with MDMA challenge. No correlation between gender, body mass or surface area and HyT was found. No differences in \( T_{\text{max prior}} \) to L-NAME were seen in any group. \( EC_{50} \) increased only in females treated with MDMA and \( T_{\text{max}} \) increased following L-NAME only in females treated with MDMA. Both males and females showed a significant increase in plasma NE but males showed greater concentrations than females. UCP3 expression following MDMA was 60% less in female than males.

PKC AND PKA INHIBITORS REVERSE ACUTE TOLERANCE TO LOW AND MODERATE BUT NOT HIGH EFFICACY \( \mu \) OPIOID AGONISTS Lynn C. Hull, Bichoy H. Gabra, Forrest L. Smith, and William L. Dewey Pharmacology and Toxicology, Virginia Commonwealth University Medical Center, Richmond, VA. The present study was designed to investigate possible differing mechanisms of tolerance to opioids of various efficacies. We, as well as others, have shown that the administration of highly selective inhibitors of protein kinase C (PKC) and A (PKA) completely reversed morphine antinociceptive tolerance in mice. We now have investigated whether these inhibitors reverse tolerance to other opioids of low and high efficacy. An 8-hr model of acute tolerance was used in which the test opioid was administered repeatedly at a dose which yielded maximum antinociception in naïve mice. Animals were then challenged with increasing doses of the test opioid with and without the PKC and PKA inhibitors to construct a dose response curve. The 8-hr tolerance to the low-efficacy \( \mu \)-agonist meperidine and the moderate-efficacy \( \mu \)-agonists, morphine and fentanyl was fully reversed by the PKC inhibitors Bisindolylmaleimide I, and Gö6976 as well as the PKA inhibitor PKI 14-22. However tolerance to [D-Ala\(^2\), N-Me-Phe\(^4\), Gly\(^5\)-ol]-enkephalin (DAMGO), a highly efficacious \( \mu \)-opioid agonist, was not reversed by injection of either the PKC inhibitor Gö6976 or the PKA inhibitor PKI 14-22 suggesting that \( \mu \)-opioid receptor desensitization induced by high-efficacy \( \mu \)-agonists is independent of PKC or PKA
activation. It can be concluded that the mechanisms underlying µ-opioid receptor desensitization may be determined by the agonist activating the receptor. Supported by DA01647 and DA020836.

**Microbiology and Molecular Biology – See Biology**

**Natural History & Biodiversity**

**BENEFITS AND DRAWBACKS OF USING MANOVA AND CIRCULAR STATISTICS TO ANALYZE BI-VARIATE DATA.** Jason J. Schaffter, Cynthia M. Jones, & Dayanand N. Naik, Center for Quantitative Fisheries Ecology and Dept. Statistics, Old Dominion Univ., Norfolk VA 23508. Traditionally, ecologists have relied on qualitative interpretations of bi-plots to explore food web interactions. Food webs are constructed based on flows of carbon and nitrogen and the resulting fractionation between different trophic levels. Rigorous statistical approaches for testing hypotheses in this field have lagged behind other areas of ecology. Recently, circular statistics has been proposed as a means of quantifying differences in food webs. We feel that the limitations of circular statistics has not been fully stated and there are standard approaches available that should be considered. We compare the use of multivariate analysis of variance (MANOVA) with circular statistics.

**QUANTIFYING THE VALUE OF A NURSERY HABITAT USING THE SPOTTED SEATROUT (CYNOCION NEBULOSUS) IN AN ESTUARINE SYSTEM.** Stacy K. Beharry & Cynthia M. Jones, Center for Quantitative Fisheries Ecology, Old Dominion Univ., Norfolk VA 23508. Nursery habitats such as seagrass beds are important for the health and sustainability of many fisheries. In fact, seagrass beds are considered to be “essential nursery habitats” and as a part of the Sustainable Fisheries Act (SFA) of 1996 it was mandated that these areas be protected. However, no one has developed a method of quantifying the important nursery habitats. To designate an area as an “essential fish habitat” greater survival of juvenile fish to adulthood must be met. In the Chesapeake Bay, seagrass beds are considered to be as nursery habitat, but bed -specific survival of juvenile fish is unknown. To estimate survival we are using fish otoliths, or ear bones, as a natural tag from spotted seatrout (*Cynocion nebulosus*). The seatrout is a model species for this work as individuals maintain a tight relationship with their natal beds. Juveniles obtain an otolith chemical signature unique to their natal bed which can be used to identify the natal beds of adults. From this, it will be possible to develop a ratio estimator for the number of adults produced from the relative abundance of juveniles on each bed. This gives us a method for quantifying seagrass beds as essential habitat based on fish production. This work will have far reaching effects,
A COMPARATIVE TIME BUDGET ANALYSIS OF FOUR EMBALLONURID BAT SPECIES AT LA SELVA BIOLOGICAL STATION IN COSTA RICA. Christina Harview¹ & Mirjam Knörrschild² ¹Bryn Mawr College, 101 N. Merion Avenue, Bryn Mawr, PA, 19010; ²Department of Zoology, Institute for Biology, FAU Erlangen-Nuremberg, 91058 Erlangen, Germany. The goal of this study was to determine if there is a connection between mating system and behavioral complexity in four species of Neotropical bats. Twenty-two key behaviors were documented to describe the dayroost activities of four sympatric Emballonurid bats in Costa Rica. Time budget analyses along with focal animal sampling methods were used to observe eight bat colonies with two to ten individuals each. Data show that although there is no correlation between non-interactive behaviors and mating system, there is a positive correlation between interactive behaviors and mating system. This implies that interactive behaviors have a positive evolutionary link to mating systems. Bats with more complex mating behavior may face a selective pressure for more complex interactive behaviors.

THE 2007 VIRGINIA SOCIETY OF ORNITHOLOGY BREEDING BIRD FORAY: A FOCUS ON VIRGINIA STATE PARKS. Andrew S. Dolby. Dept. of Biological Sciences, Univ. of Mary Washington, Fredericksburg, VA 22401. For its 2007 Breeding Bird Foray, the VSO surveyed the Virginia State Park system. Seventy-eight participants spent roughly 270 hours surveying 30 state parks. Park areas ranged from 250 to 7,691 acres, and observation time per park averaged 10.4 hrs. A total of 158 species were detected, and the most common species overall were Red-eyed Vireo, Common Grackle, Tufted Titmouse, and Northern Cardinal. While the most species rich park was Sky Meadows, with 96 species detected, the average number of species per park was 60.7. Sailor's Creek Battlefield had the fewest species. Direct signs of breeding activity, including sightings of obvious pairs, active nests, and juveniles, were reported for 80 species. Variation in species richness across parks was most likely influenced by factors such as habitat diversity, chance detection of rare and unusual species, and area of intact habitat surrounding park boundaries. Comparison of results with those of previous forays revealed declines in many species, especially insectivorous neotropical migrants. Future forays should revisit the state park system.

DIVERSITY OF HYMENOPTERA IN BURNED AND UNBURNED AREAS AT THE BLACKWATER ECOLOGICAL PRESERVE. Braeden A. Miller & Deborah A. Waller, Dept of Biol, Old Dominion Univ., Norfolk VA 23529. The objective of this research was to examine Hymenoptera from sites subjected to prescribed burns as managers can use this research as an ecosystem-based approach to adequately assess the value of individual nursery areas.
and from control, unburned sites in a longleaf pine forest in southeastern Virginia. In 2002, insects were collected from Malaise traps set in two burned sites and two control sites. Trap collections were made from March through May and specimens identified to order. The present study identified the Hymenoptera in those samples to the family level. Ichneumonidae and Braconidae, both parasitic wasps, were the most abundant families, followed by Sphecidae, which include predatory and parasitic wasps, and Tenthredinidae, the sawflies. Ichneumonidae and Tenthredinidae were most common in the control sites, while Braconidae was found only in the burned areas. Sphecidae was also more common in burned sites. Also present were Scoliidae and Tiphidae, both parasitic on beetles, and Vespidae, including the paper wasps, yellowjackets and hornets. This research is continuing with the addition of other trap types and collection of host plants and insects to rear parasitoids. A focus will be determining why some families are more prevalent in either the burned or control habitats.

EFFECTS OF POPULATION DENSITY ON SEED PREDATION OF *AESCHYNOMENE VIRGINICA*, A RARE, TIDAL, WETLAND ANNUAL. Tanima Hoque & Alan B. Griffith, Dept. of Biol. Sciences, Univ. of Mary Washington, Fredericksburg, VA 22401. *Aeschynomene virginica* or sensitive joint-vetch is a federally threatened annual legume that is found in populations from southern New Jersey to central North Carolina. Potentially severe seed loss from herbivory has been observed in *A. virginica* populations, but not measured. We studied the effect of population density on seed predation of *A. virginica* at the Vandell Preserve at Cumberland Marsh Preserve in New Kent County, Virginia. In September 2007, all known populations of *A. virginica* were sampled. We censused all plants in each population and measured the area covered by each population. We counted number of seeds produced and number of seeds eaten on ten randomly selected plants in each population. Seed predation rates were defined as either percent of seeds eaten per plant or average percent of seeds eaten in a population. Number of seed eaten per plant increased as seed production per plant increased. But, there was no significant relationship between percent of seeds eaten per plant and number of seeds per plant or number of plants per population. These results are consistent with other seed predation studies where no density dependent relationship of seed loss was found.

COST-TIME EFFICIENCY OF AGING MENHADEN (*BREVOORTIA TYRANNUS*) SCALES VERSUS OTOLITHS. Billy Culver, Jason J. Schaffler, & Cynthia M. Jones, Center for Quantitative Fisheries Ecology, Old Dominion Univ. Norfolk VA 23508. Menhaden (*Brevoortia tyrannus*) have historically been an important commercial fishery of Chesapeake Bay, requiring intense management of the fishery. However, before fisheries management regulations can be formulated, information regarding menhaden population dynamics in the bay is needed. One important piece of information is the age-length relationship of juvenile menhaden.
Traditionally, aging menhaden has relied on scales; however, otoliths are generally accepted to be more accurate. In our evaluation we compared both methods of aging juvenile menhaden from Chesapeake Bay. To evaluate these two methods we compared the predicted lengths of age one juveniles using back calculated lengths-at-age from otoliths and scales. Using repeated measures analysis of variance we were able to determine that the two methods were not significantly different. Since the time to prepare and age menhaden with scales is considerably less than with otoliths, and the cost of equipment is also reduced, the cost-time benefits suggest that aging menhaden with scales is more efficient and to be preferred.

OPISTHOBRANCH MOLLUSKS FROM THE CHESAPEAKE BAY OF VIRGINIA (MOLLUSCA: GASTROPODA: OPISTHOBRANCHIA). Pamela Bray & Deirdre Gonsalves- Jackson, Dept of Biology, VIRGINIA WESLEYAN COLLEGE, Norfolk, VA 23502. Few studies exist documenting the diversity of opisthobranch mollusks from the Chesapeake Bay of Virginia and to date only 21 species have been recorded. The goals of this ongoing research have been to survey and document the diversity of marine slugs in the Atlantic waters of the Eastern Shore and the Chesapeake Bay. Collection of opisthobranchs was done through dredging and wading at low tide. Specimens were identified to the species level and cultured in the laboratory to determine mode of development. Twenty sites and thirty-six specimens were collected from April – August 2007 and March 2008. Two species in Order Nudibranchia, *Doriopsilla pharpa* and *Doridella obscura*, have been identified. Both species were collected from the Atlantic waters of the Eastern Shore and are new records for this area. *Doriopsilla pharpa* appears to show seasonal variation in abundance with April-July being peak abundant periods and lays eggs in late spring/ early summer. Development for *D. pharpa* was confirmed in the laboratory as direct development with eggs hatching within 12 days as juveniles. This study brings the number of documented species to 19% with one additional species not previously recorded from the Chesapeake Bay.

THE ECOLOGY OF FEAR: COLONIZATION AND OVIPOSITION IN AQUATIC SYSTEMS. L. T. Pletcher, J. R. Vonesh, & J. M. Kraus. Dept. of Biology, VCU, Richmond, Virginia 23284-2012. Amphibians and aquatic invertebrates have complex life histories that link aquatic and terrestrial food webs. It has been suggested that amphibian reproduction is an important source of carbon to some aquatic systems. This process of energy flow may be shaped by shifts in habitat selection in response to predators. We hypothesized that predators decrease colonization and oviposition of prey, reducing active inputs. Thus predation risk is expected to shift the relative amounts of active and passive subsidies. We manipulated the presence of fish predators in aquatic mesocosms. Results suggest Hylid treefrog eggs and hydrophilid beetles were less abundant in predator treatments. This difference in oviposition and colonization translated into small reductions in calories and ash free dry mass of active inputs. However, passive
allochthonous inputs were more than double active amounts and variable, therefore relative amounts of active and passive inputs did not differ across the levels of predation risk.

THE MANAOSBIIDAE (OPILIONES, LANIATORES) OF PANAMA. Victor R. Townsend, Jr., Department of Biology, VIRGINIA WESLEYAN COLLEGE, Norfolk, VA 23502. In February 2007, harvestmen (116 specimens, 19 species) were collected over five days in Parque Nacional de General Division Omar Torrijos in El Cope, Cocle Province, Panama. In addition to an assortment of cosmetid and sclerosomatid taxa, 10 individuals representing four species of harvestmen from the family Manaosbiidae were captured. A single adult male of Barrona williamsi Goodnight and Goodnight 1942 was identified. This is the first record of this species from outside the canal zone. The other specimens represent previously three undescribed taxa, including new species of Bugabitia (3 adult females) and Barrona (an adult male and female), and a yet unidentified (new) genus (4 specimens). The addition of these taxa increases the total number of manaosbiid species known for Panama and Costa Rica to seven.

DIVERSITY OF CARRION BEETLES AT THE ZUNI PINE BARRENS. Amy L. Simons, Sarah M. Scott & Deborah A. Waller, Dept of Biol, Old Dominion Univ., Norfolk VA 23529. This study was conducted in a longleaf pine preserve where controlled burning is performed to restore the forest. The research objective was to study the density and diversity of carrion beetles (Family Silphidae) in burned versus non-burned areas over a three-year period. Nine beetle species were expected, including members of the genera Necrodes, Necrophila and Oiceoptoma in the subfamily Silphinae, and the genus Nicrophorus in the Nicrophorinae. The Silphinae use large carcasses and the Nicrophorinae use small carrion that they bury to rear their young. Two trap types were used: a plastic bottle trap tied to a tree and a wooden trap on the ground. Both were baited with a 50/50 mix of cat food and mackerel. Two sets of four trapping locations (two burned and two unburned) were alternated weekly (first year) or monthly (second and third years). Initially beetles were brought to the laboratory for identification. Later beetles were released following field identifications. Of the nine species expected in southeastern Virginia, seven were found, but Nicrophorus carolinus and Nicrophorus marginatus were absent from the Zuni Pine Barrens. More beetles were found in non-burned than in burned trapping locations, perhaps due to increased ground vegetation. Beetles were more abundant in summer than any other season, perhaps due to the peak reproductive activity in summer.
ALLELOPATHIC EFFECTS OF *AILANTHUS ALTISSIMA* ON GERMINATION AND GROWTH OF NATIVE AND INVASIVE PLANTS IN SOUTHWESTERN VIRGINIA. Breanna L. Hargbol & Christine J. Small, Dept. of Biology, RU, Radford VA 24142. Invasive species are detrimental to natural systems, frequently altering the abiotic environment and aggressively displacing native species. Like many problematic invasives, *Ailanthus altissima* (Tree of Heaven) grows rapidly, matures early, and reproduces prolifically, often producing > 20,000 seeds per growing season. *Ailanthus* also has been shown to negatively impact ecosystems through the production of allelopathic compounds (e.g., quasinoids) inhibitory or toxic to other plant species. To determine the effects of *Ailanthus* allelopathy on native communities of southwestern Virginia, we collected replicate soil samples from two forested stands dominated by *Ailanthus* (treatment) and two forested stands lacking *Ailanthus* (control). We compared germination, height, leaf production, and root:shoot ratio of *Daucus carota* (Queen Ann's Lace), *Verbesina occidentalis* (Crown Beard), *Lactua sativa* (Lettuce), and *Dipsacus fullonum* (Teasel) grown in these soils. Plant growth was measured three times weekly for six weeks. *Ailanthus* soil negatively impacted germination and leaf production of *D. carota* (*p* < 0.05) but not height. All growth measures of *V. occidentalis* were negatively affected (*p* < 0.01). *Ailanthus* had no impact on *D. fullonum* (*p* > 0.30), a non-native invasive plant. Our results suggest that native plant species may be more severely impacted by allelopathic affects of invasives like *Ailanthus*.

DIVERSITY OF CARRION FLIES AT THE ZUNI PINE BARRENS. Sarah M. Scott, Amy L. Simons & Deborah A. Waller, Dept of Biol, Old Dominion Univ., Norfolk VA 23529. Carrion flies are holometabolous insects whose life cycle is predictable and often associated with certain stages of decomposition. They are important nutrient recyclers in the ecosystem as well as invaluable for the determination of post mortem interval in the field of forensic science. The Zuni Pine Barrens is a tract of land that is primarily composed of *Pinus palustris*, longleaf pine, and burned regularly to promote growth and seed germination. This study focused on *Calliphoridae* and *Sarcophagidae* in the burned and unburned habitats. Two hypotheses were tested: 1) carrion fly abundance will differ in burned versus unburned habitats, and 2) some species will be more abundant in the warmer summer months as opposed to the cooler winter months. Little is known of the fly fauna of southeastern Virginia and previous research has not focused on the effects of prescribed burns on fly distributions. Two different trap types were used, including one that collected larvae and another that collected adults. Eight trapping locations were divided into two sets, with each set containing two burned and two unburned areas. Collections were made over a three-year period, and larvae were reared to maturity in the laboratory. Preliminary results suggest that the *Sarcophagidae* far outnumbered the *Calliphoridae*. Both families were collected in burned and unburned areas. Distributions and seasonal occurrence of different species will be determined following completion of specimen identifications.

Sheepshead are an estuarine/marine member of the porgy family that have long supported large recreational fisheries along the southeastern coast of the United States, with a recently expanding recreational fishery in Virginia waters of the Chesapeake Bay. Due to this expansion into Bay waters, Virginia fisheries managers need to develop a management plan for this species and determine if Chesapeake Bay sheepshead constituted a separate population from sheepshead found further south. However, before any management plan or determination on population structure can be developed, a comprehensive understanding of the age structure and growth rates of fish in the population is needed. To characterize the age and growth of sheepshead in the Chesapeake Bay, we collected fish captured via Bay fisheries and obtained their lengths, weights and ages. Sheepshead ranged in age from 0 to 34 years old, with the oldest fish being 11 years older than the oldest sheepshead previously reported. A Kimura's likelihood ratio test indicated that there is no dimorphic growth differences between sexes with regards to length-at-age or the length-weight regression. Results of the von Bertalanffy length-at-age analysis, weight-at-age analysis, and length-weight regressions suggest that Chesapeake Bay sheepshead are attaining larger sizes than sheepshead found elsewhere along the coast of the United States. This is strongly suggestive that the Chesapeake Bay sheepshead population constitutes a separate population, as large differences in vital rates are often indicative of this.

Correlation of eastern wild turkey poult:hen ratios with population indices to detect reproductive density dependence. Jay D. McGhee & Jim Berkson, 1University of Mary Washington, Department of Biological Sciences, Fredericksburg, VA 22401, 2National Marine Fisheries Service RTR Unit at Virginia Tech, 100 Cheatham Hall, Blacksburg, VA 24061. Knowledge of how density affects population growth is important for the harvest management of wild turkey (*Meleagris gallopavo*). Unfortunately, available time-series are often too short for statistical detection of density dependence. The correlation between wild turkey recruitment and population size was assessed using data from 7 state wildlife agencies, circumventing the problem of short time-series by using multiple datasets. Correlation coefficients were calculated between surveyed poult:hen ratios and harvest-based population indices for 29 geographic or harvest management regions. Correlation coefficients for the 29 regions ranged from -0.82 to 0.70. A Q-test for homogeneity indicated that correlation coefficients were similar enough to warrant averaging \([Q=25.45, \text{df} = 28, P = 0.603]\). The weighted average correlation coefficient \((\pm \text{standard error})\) was \(-0.30 \pm 0.17\). Population size accounted for little of the variation associated with production \((r^2 = 0.09)\). Graphical analysis indicated that a negative correlation between poult:hen ratios and population size...
tended to occur when the range of population sizes was large. Density dependence appears to have little effect on production. Density-independent models should have better success modeling wild turkey production, while stronger density-dependent effects may have stronger influence on survival or immigration at low population sizes.

NECTAR CONSUMPTION BY SPIDERS – A CRACK IN THE GENERALIST PREDATOR PARADIGM. M. A. Milne & D. A. Waller, Department of Biology, ODU, Norfolk, VA 23508. Representatives of three families of spiders (Linyphiidae, Lycosidae, and Agelenidae) and one family of harvestman (Leiobunum) were assessed in the laboratory for their affinity to consume several types of sugary solutions. Tested sugary solutions included honey, 10% sucrose solution, 5% sucrose solution, 0.5% sucrose solution, extrafloral nectar (Prosopis glandulosa), and floral nectar (Nematanthus gregarius). All arachnids were exposed to honey, members of Linyphiidae and Lycosidae were also exposed to 10% sucrose solution, and nectar was only exposed to Linyphiidae. Arachnids were simultaneously subjected to water and the specified solution within a large arena and the time that each subject spent consuming the solution was recorded. All subjects drank honey when offered and there was no significant difference between subjects in their time spent drinking honey \((p = 0.434)\). The Linyphiidae and Lycosidae representative both drank 10% sucrose for a longer period of time than the honey \((p < 0.001)\), suggesting that the concentration of sucrose may be correlated with the amount consumed. The Linyphiidae representative also drank the extrafloral and floral nectar offered.

USING TAGS TO SAMPLE LARGE VALUABLE FISH. N. Prista1, J. L. Costa1, M. J. Costa1 & C. M. Jones2, 1Centro de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal and 2Center for Quantitative Fisheries Ecology, Old Dominion University, Norfolk, VA 23508. Fishery-dependent surveys are the main source of biological information for large valuable fish species (LVFS). However, even market sampling surveys can be made difficult by size grading practices, the need to minimize market place interference, the need to preserve specimen’s appearance and budget constrains in fish acquisition. In the case of LVFS these situations frequently lead to adoption of suboptimal sampling designs. We developed a new fishery-dependent sampling methodology – termed “commercial mark-recapture” (CMR) - that allows the collection of representative numbers of biological samples (e.g. otoliths) from fisheries landings with minimal cost and reduced sampling site interference while retaining spatial, temporal, size and fishing gear discrimination. The methodology is based on the measuring and tagging of landed individuals for latter recapture of their tags and samples within the commercial circuit. A first application of CMR was performed in Portugal during 2004-2006 in the study of Argyrosomus regius, a large valuable sciaenid (over 20lb and 200 USD per fish). A 75% recapture rate was
achieved (279 fish samples, >4 tons of fish, >$60000 in value), at negligible costs. A binomial distribution was used to model this CMR application and can be used to obtain unbiased biological samples from fisheries landings of other LVFS worldwide, including some from Virginia’s waters. This study was funded by FCT (grant ref: BD/12550/2003) and DGPA (project Mare ref: FEDER-22-05-01-FDR-00036).

ECOLOGICAL AND VEGETATION RESPONSES FROM TWO DAM REMOVALS IN A TIDAL WETLAND SYSTEM. Damon Lowery & Alan B. Griffith. Dept. of Biol. Sciences, Univ. of Mary Washington, Fredericksburg, VA, 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. Our interdisciplinary study aims to measure impacts of dam removal on stream physical characteristics, vegetation, aquatic invertebrates, and fish along Holts Creek, a tributary to the Pamunkey River in New Kent County, VA. This research reports pre-dam removal plant distribution and abundances. To assess distribution and abundance of vegetation, ten transects were constructed along the entire drainage between the two dams. The presence of tree, sapling, vine, and herbaceous species were systematically sampled at each transect. Among all transects there were 18 tree species, 23 sapling species, 5 vine species, and 71 herbaceous species. Out of the 71 herbaceous species, the most abundant was *Murdannia keisak*, which is an invasive species. *M. keisak* was present at 6 of the 8 transects sampled, and had an average percent cover of 20%. Several other invasive herbaceous species were also present in high abundances. High relative abundance of *M. keisak* and other invasive species pose a potential problem when dam removal occurs, due to their ability to effectively disperse and quickly colonize newly barren sediments. As dam removal proceeds, it will be essential to monitor the establishment of these species and to determine their effects on other plant species.

CLASSIFICATION OF THE ECOLOGICAL COMMUNITIES OF THE SELU CONSERVANCY IN SOUTHWESTERN VIRGINIA. M.T. Baisey, C.J. Small, & K.A. Francl, Dept. of Biology, RU, Radford VA 24142. The classification of natural communities provides valuable information to better manage conservation efforts. Because plants are especially reliable indicators of biological and ecological conditions, vegetation typically is used to define communities. Selu Conservancy, located in Montgomery County, southwest Virginia, protects ~154 ha of diverse natural communities in Virginia’s Ridge and Valley Province. Our research focused on the classification of ecological communities at Selu, supporting efforts by the Virginia Natural Heritage Program to document and protect state natural areas. In 2007, 99 – 100 m² sample plots were established throughout the Conservancy to characterize vegetation composition, structure, and associated habitat features
(topography, soil moisture and fertility, canopy cover, etc.). Twelve ecological communities were identified based on ordination and cluster analyses, including two of state significance: Low-Elevation Boulderfield Forests and Basic Mesic Forests. As an extension of this work, our classification is being used to investigate the distribution of small mammals and impacts of invasive species across natural habitats of Selu. These data provide additional information to the already extensive database of Virginia’s natural communities. This information will be used to help develop effective conservation programs by allowing focus on management at an ecosystem level rather than on individual species.

RESOURCE PARTITIONING BY SUBTERRANEAN TERMITES IN SOUTHEASTERN VIRGINIA. Kinner M. Patel & Deborah A. Waller, Dept of Biol, Old Dominion Univ., Norfolk VA 23529. The objective of this research was to determine how three very similar subterranean termite species, Reticulitermes flavipes, R. hageni and R. virginicus (Family Rhinotermitidae) coexist in southeastern Virginia. These sympatric species nest underground and feed on surface and buried logs. We established bait grids at three sites at the Blackwater Ecological Preserve in Isle of Wight County. Site I was a mesic pine forest, Site II was a dry pine forest, and Site III was a mesic hardwood forest. Grids were 80 x 80m with 25 cardboard bait traps spaced every 20m. We also measured diameter of logs along 100m transects in each site and identified any termites in the wood. All three species were found in either baits or logs at both Sites I and II. No termites were collected from Site III. Site I had more R. virginicus, Site II more R. hageni, but R. flavipes was present equally at both sites. Logs with R. flavipes tended to be smaller in diameter than those with the other species. These results support previous work suggesting that habitat moisture and log size might influence Reticulitermes species distributions and foraging patterns.

SURVEY OF SPOTTED SALAMANDERS (AMBYSTOMA MACULATUM) IN VERNAL POOLS AT THE WALTER AND INGER RICE CENTER FOR ENVIRONMENTAL LIFE SCIENCES. L. T. Pletcher1, C. Viverette2, A. B. Wright1, J. L. Ware3, R. Dyer1, S. Crouch1, J. D. Kleopfer4, & R. Knapp1. 1Dept. of Biology, VCU, Richmond, Virginia 23284-2012. 2Center for Environmental Studies, VCU, Richmond, Virginia 23284-3050. 3Dept. of Pathology, VCU School of Medicine, Richmond, Virginia 23298 and 4Virginia Dept. of Game and Inland Fisheries, Charles City, Virginia 23030. Surveys of spotted salamanders (Ambystoma maculatum) in vernal pools were undertaken in winter of 2006 and 2007 at the VCU Walter and Inger Rice Center for Environmental Life Sciences. Spotted salamanders occur in Virginia’s Coastal Plain, and in Charles City County. Little is known about the population characteristics of these salamanders and the vernal pool community in which they breed. A long-term population monitoring program was begun in eight small vernal pools to understand this breeding habitat, document the timing of the breeding migration, and determine the health status and
population size of spotted salamanders. To date, hundreds of salamanders have been weighed and measured, examined for abnormalities, and photographed. Disease has been documented within the population.

POSTEMBRYONIC DEVELOPMENT IN NEOTROPICAL HARVESTMEN FROM TRINIDAD, W.I. (OPILIONES, LANIATORES, CRANAIDAE). Nouman J. Rana¹, Daniel N. Proud², Philip Rock¹, & Victor R. Townsend, Jr.¹. ¹Department of Biology, Virginia Wesleyan College, Norfolk, VA 23502 and ²Department of Biology, University of Louisiana at Lafayette, Lafayette, LA 70504-2451. In this study, we described postembryonic development in the Cranaidae on the basis of the examination of individuals representing two species, *Phareicrananus calcariferus* and *Santinezia serratotibialis*. Individuals (adults, nymphs and larvae) were collected over the course of three years (2005-2007) on the Caribbean island of Trinidad. The life history of both species features six nymphal stages. Pigmentation and body shape changed dramatically during development. Growth rates for nymphs were similar for both species. In *S. serratotibialis*, the greatest percent increase in leg size occurred from larval phase to 1st nymph. Other ontogenetic changes that were observed included development in the size and complexity of the first cheliceral segment, ocularium, pedipalp, opisthosoma, distitarsus, and leg IV. Postembryonic development in cranaid harvestmen follows a pattern similar to that reported for other species in the Laniatores.

Psychology

TIME PERSPECTIVE AND RISKY BEHAVIOR: MODERATING EFFECTS OF RELIGIOSITY. M. R. Pearson & J. M. Henson. Old Dominion Univ., Norfolk VA. Time perspective and religiosity have yet to be considered together as antecedents to risky behaviors. The present study examined whether religiosity moderates the relationship between five dimensions of time perspective (Present-Hedonism, Present-Fatalism, Future, Past-Negative, Past-Positive) and risky behavior. It was predicted that Present-Hedonism and Present-Fatalism would display a buffering interaction with religiosity, and that Future time perspective would display an antagonistic interaction with religiosity. Survey data were collected from 493 college students. As predicted, a buffering interaction was found between Present-Hedonism and religiosity for two different alcohol outcome measures, indicating that religiosity acted as a protective factor that buffered against the risk associated with Present-Hedonism. However, there was no support for the other predicted interactions. An unexpected synergistic interaction was found between Past-Negative and religiosity in regards to the risky sex outcome variable. Closer analysis reveals that Past-Negative was negatively associated with risky sex, but only for individuals high in religiosity. In sum, there is some evidence that religiosity moderates the relationship between Present-Hedonism and risky alcohol use, and there is preliminary evidence that religiosity moderates the relationship between
Past-Negative and risky sex. Both Present-Hedonism and religiosity need to be considered when one is interested in either.

DISCRIMINATIVE STIMULUS PROPERTIES OF THE GLUTAMATE AGONIST N-METHYL D-ASPARTATE IN C57BL/6 MICE. Sarah A. Vunck\textsuperscript{1}, Jason M. Wiebelhaus\textsuperscript{1}, Jørn Arnt\textsuperscript{2} & Joseph H. Porter\textsuperscript{1}.\textsuperscript{1}Department of Psychology, Virginia Commonwealth University, Richmond, VA USA,\textsuperscript{2}Lundbeck Research Denmark, Copenhagen-Valby, Denmark. The glutamate hypothesis of schizophrenia postulates that there is a hypo-functionality of the N-methyl D-Aspartate (NMDA) receptor subtype in the psychopathology of schizophrenia. The atypical antipsychotic clozapine (CLZ) has been shown to increase the outflow of glutamate in the prefrontal cortex of rats and enhance NMDA currents. Given this interaction between CLZ and glutamate, it is of interest to evaluate whether the discriminative stimulus properties of CLZ and NMDA are similar to one another. In the current study, two groups of C57BL/6 mice were trained in a two-lever drug discrimination task. One group was trained to discriminate 2.5 mg/kg CLZ from vehicle and a second group was trained to discriminate 30 mg/kg NMDA from vehicle. Generalization curves were generated for both groups after training criteria were met, yielding an ED\textsubscript{50} = 0.92 mg/kg (95% C.I. = 0.66-1.29 mg/kg) for CLZ and an ED\textsubscript{50} = 10.80 mg/kg (95% C.I. = 7.69-15.16 mg/kg) for NMDA. Cross-generalization testing revealed that NMDA (3, 10, 30, and 56 mg/kg doses were tested) failed to generalize in the CLZ-trained mice. A maximum % drug lever responding (%DLR) of 25.1% occurred at the 56 mg/kg dose, which also produced significant rate suppression. In the NMDA-trained group, CLZ (0.15625, 0.3125, 0.625, 1.25, 1.77, 2.5, and 5.0 mg/kg doses were tested) produced a maximum of 58.8% DLR at the 0.625 mg/kg CLZ dose with rate suppression occurring at the 5.0 mg/kg dose.

REVIEWING THE REVIEWERS: A SECOND LOOK AT BOND & SMITH'S (1996) META-ANALYSIS OF ASCH-TYPE LINE JUDGMENT STUDIES. R.E. Frank, Virginia Wesleyan College, VA 23502 & J.P. O'Brien, Tidewater Community College, VA 23453. Bond and Smith's 1996 cross-cultural meta-analysis of 133 conformity studies using Asch's (1952b, 1956) line judgment task is widely cited both for its findings (more conformity in collectivist than in individualistic cultures; a decline in conformity in the U.S. since the 1950's) and its methodology. Included in this paper, is an Appendix "A" that provides readers with classifications for a subset of the moderator variables included in the meta-analysis, calculations for % errors and % errors controls, and effect size (d) values. As part of a larger research effort, 58 of the studies included in Appendix A were independently reviewed. This review revealed 78 discrepancies (52 unambiguous errors and 26 judgment call disagreements) between our reading of the primary sources and Bond and Smith's classifications in Appendix A. The most significant unambiguous error is the reporting of Asch's 1956 % errors controls as 0.5 rather
than as 0.7, a difficulty that affects 34 of the 58 studies in our sample as well as all
the studies in the overall sample of 133 studies which used Asch 56 stimuli but
which did not report independent control groups. Judgment call disagreements are
notable because Bond and Smith saw their task as one of data extraction, not as one
of judgment. How these discrepancies escaped notice by the editors/reviewers at
Psychological Bulletin as well as by the wide audience of scholars who have cited
the article in the past decade deserves further study. The immediate lesson learned is
that if science is to be more than a collective illusion, each of us must take
responsibility for verifying the truth of its claims.

Statistics

A COMPARISON OF DIFFERENT METHODS FOR PREDICTIONG CANCER
MORTALITY COUNTS AT THE STATE LEVEL. Corinne Wilson, Department
of Mathematics and Statistics, Old Dominion University, Norfolk, VA 23529.
Cancer affects everyone. It is the main cause in one out of every four deaths in the
United States. The American Cancer Society has used several methods of
forecasting to estimate the future cancer burden and researchers are continually
working to develop new methods with improved performance. There have been
studies comparing different models for predicting the US cancer mortality counts.
In this study we explore and compare several different models for cancer mortality
count predictions at the state level, especially for the state of Virginia. Different
cancers are used in the study and in some cases the models give rather peculiar
predictions.

STUDYING THE EFFECTS OF CORRELATION ON PROTEIN SELECTION IN
HIGH DIMENSIONAL PROTEOMIC DATA. Savita Venkataramani & Dayanand
N. Naik, Department of Mathematics and Statistics, Old Dominion University,
Norfolk, VA 23529. Mass-spectrometry based protein profiling is a method to
analyze protein expressions of biological samples. One of the main problems of
interest here is the selection of critical proteins from a list of thousands of possibly
expressed proteins. Typically this selection is done by performing thousands of t-
tests or ANOVA F tests (one corresponding to each protein) and ordering them
according to the test statistics or the p-values. However, the selection may be
affected by the correlation that exists between the test statistics. In a recent paper,
methods for assessing the effect of correlation in large-scale testing problems. Using
two popular microarray data sets, namely, breast cancer and HIV, he illustrated the
effect of correlation on the false discovery rate (FDR). Although FDR procedure
does not require independence of the tests, existence of correlation grossly under or
overestimates the number of critical genes. Efron discusses the use of his empirical
null distribution to alleviate this problem. In this note we briefly review Efron's
method and apply the similar techniques to proteomics data. In particular we work
with Duke University's lung cancer samples. We show that even in spectrometry proteomics data and for relatively smaller number of simultaneous hypothesis testing, the correlation can affect the FDR values and the number of proteins declared as critical.

AN INTERACTIVE TOOL TO DEMONSTRATE ASSOCIATIONS BETWEEN EDUCATIONAL ATTAINMENT AND ALL-CAUSE MORTALITY. Tina D Cunningham & Robert E Johnson, Department of Biostatistics, Virginia Commonwealth University, Richmond VA 23298-0032. This simple tool was developed to provide the public and policymakers a general picture on the association between educational attainment and mortality in all 50 states and 524 counties in the US. Numerator data (2004 deaths) was downloaded from the National Bureau of Economic Research (NBER) website. Denominator data (2004 population) was downloaded from the American Community Survey (ACS). The number of averted deaths was computed as a function of higher education proportion. Missing information on educational attainment was imputed based on the surrounding states. Population counts for 280 counties were extrapolated from 2006 ACS data. The final result was a website with an interactive tool that enables users to input data and receive personalized output with interactive features.

CONTROL CHARTS WITH MISSING OBSERVATIONS. Sara R. Wilson & Marion R. Reynolds, Jr., Department of Statistics, Virginia Polytechnic Institute and State University, Blacksburg, VA 24060. Traditional control charts for process monitoring are based on taking samples from the process at regular time intervals. However, in practice it is possible for observations, and even entire samples, to be missing. Three methods are investigated for adjusting the weights in the control statistic of the Exponentially Weighted Moving Average (EWMA) control chart to account for missing observations. The case in which individual observations are taken at each sampling point as well as the case in which the sample size is greater than one are examined. Markov chain and integral equation methods are developed to evaluate and compare the statistical properties of these charts. The multivariate case in which information on some of the variables is known while information on the other variables is missing is also considered using Multivariate EWMA (MEWMA) charts.

PROFILE MONITORING ANALYSIS USING SEMIPARAMETRIC AND NONPARAMETRIC METHODS. Abdel-Salam G. Abdel-Salam & Jeffrey B. Birch, Virginia Polytechnic Institute and State University, Blacksburg, VA. Profile monitoring is a relatively new technique in quality control best used where the process data follow a profile (or curve) at each time period. The majority of previous studies in profile monitoring focused on the parametric modeling of either
linear or nonlinear profiles, with both fixed and random-effects, under the assumption of correct model specification. Our work considers those cases where the parametric model for the family of profiles is unknown or, at least uncertain. Consequently, we consider monitoring profiles via two methods, a nonparametric method and a semiparametric procedure that combines both parametric and nonparametric profile fits, a procedure we refer to as model robust profile monitoring (MRPM). We speculate that both methods will be robust to the common problem of model misspecification. Also, we incorporate a mixed model approach to both the parametric and nonparametric model fits. As a consequence, it is speculated that both the nonparametric method and the MRPM method will result in charts with good abilities to detect changes in Phase I data and have simple to calculate control limits. The new methods should provide greater flexibility and efficiency over current parametric methods used in profile monitoring that rely on correct model specification, an unrealistic situation in many practical problems in industrial applications.

ON THE APPLICATIONS OF STATISTICS IN FINANCIAL SERVICES. Seemit Sheth, Capital One Financial Corporation, Richmond, VA. Modern day decision making in financial services is getting sophisticated, and they employ large number of statisticians to make information based decisions that require the use of wide spectrum of statistical theories. In this paper, we look at two such broad areas of statistics - 1. Predictive Modeling, and 2. Design of Experiments, and give a flavor of how multi-million dollar decisions are made using the underlying statistical theories.

STABLE FRAILTY MODELS IN CONTINUOUS BIVARIATE LIFETIME DISTRIBUTIONS. Norou Diawara, Department Mathematics and Statistics, Old Dominion University, VA. This talk describes the estimation technique of the positive stable frailty model that contains a measure of dependence for a continuous bivariate lifetime distributions linearly related. The expression for the likelihood function is given under the modified Cox proportional hazard assumption, allowing inference for arbitrary data. Bayesian procedure is used to accommodate censoring or missing data information.

CLUSTER RANDOMIZED TRIALS IN PRIMARY CARE: SIGNIFICANCE TESTING AND SAMPLE SIZE. Robert E. Johnson, Dept. of Biostatistics, Virginia Commonwealth University, Richmond VA 23298-0032. The randomized control trial is the prominent methodological tool used to establish evidence in medical research. In primary care research interventions are commonly implemented at the practice or physician level. This requires all or a sample of patients within a practice or belonging to a physician’s patient panel to be randomized to intervention or
control group. Such clusters must be accounted for in the statistical analysis and determination of sample size. The variance of means or percentages has one component due to variation between the clusters (variation between practices or physicians) and another due to variation within clusters (variation among patients). Common methods of analysis for cross sectional or pre-post designs must be modified to account for these sources of variation. Sample size software is readily available for single group clustered data but is less common for controlled trials and pre-post trials. In this workshop we will illustrate the concepts of variance components and design effects related to cluster randomized trials. Common testing methodologies will be presented. Techniques for determining sample size are included.

Biomedical and General Engineering

SYSTEM MODELING OF MOBILE ROBOTS TEAM BEHAVIOR. Gail V. Megeath, R_Res Lab, Leesburg, VA, 20176. A successful deployment of any kind of systems needs an advanced modeling and simulation. The purpose of the modeling process is evaluation of functional capabilities of systems and performing optimization before their physical realization. The preliminary complex system modeling and optimization considers problems of analysis of operations that the system has to perform and their functional systematization and decomposition aiming to define general system and sub-system functions and goals. The paper considers problems of modeling of team behavior of mobile robots. The robots react when an object is sensed within an observed area. The aim of the robot team is to localize and surround the object while it moves chaotically. A Petri net model based on input, intermediate and output variables is constructed. The number of the variables and their internal organization varies depending on the team configurations around the object. A network system model for modeling and simulation of the team behavior is proposed. The system model realizes parallel computational processes. The number of the processes depends on the assigned team strategy. The functioning of the model is visualized through appropriate graphics.

POSSIBILITIES FOR A PRESSURE IMAGING AND PROCESSING APPROACH TO THE RECOGNITION OF PRESSURE ULCER FORMATION. Patrick C. Headley, Department of Biomedical Engineering, Virginia Commonwealth University, Richmond VA 23284. This work is part of an ongoing study examining the effect of head of bed elevation on skin integrity in the critically ill. Pressure ulcers are an urgent problem among persons with impaired motion, especially critically ill patients. The primary factors contributing to the development of pressure ulcers are pressure and shearing. The larger study utilizes a pressure mapping system consisting of an array of capacitance-based pressure sensors (XSENSOR Technology Corp., Calgary, Canada) to record whole-body
interface pressures between critically-ill patients and their support surfaces. This system is designed primarily for the visualization of pressure; analytical methods were developed using MATLAB (The MathWorks, Natick, MA) to enhance the capabilities of the pressure imaging system concerning the detection of trends possibly leading to pressure ulcer development. These methods enable the user to track the maximum interface pressures and pressure gradients measured on user-defined regions of the body across space and time. These methods, coupled with patient pressure ulcer development data from the ongoing study, hold the possibility to develop a methodology for the real-time clinical recognition of pressure ulcer formation.

A QUIET VEHICLE AVOIDANCE SYSTEM FOR BLIND AND DEAF-BLIND PEDESTRIANS. Justin Owen, Department of Biomedical Engineering, Virginia Commonwealth University, Richmond VA 23284. Modern cars, particularly hybrids at low speeds, are becoming quieter and quieter, posing a great threat to visually impaired pedestrians, who solely use sound to determine the safety of crossing a street. To address this problem, we propose a dualistic solution of both quiet cars adapting to visually impaired pedestrians and vice versa. The first aspect of our solution is for quiet cars to emit sounds sounding like the familiar combustion engine cars for pedestrians to judge their presence. The second aspect is for quiet cars to alert pedestrians of their presence via a Bluetooth connection to the pedestrians’ cell phones, with the cell phones providing a vibratory signal to indicate the cars’ presence. The redundant nature of our dual solution increases the safety to pedestrians. The system implementation which we propose will help these individuals maintain their independence and mobility while not subjecting them to additional costs.

TOWARDS ENTERPRISE WIDE COST MODELING: CHALLENGES AND SOLUTIONS. Yousuf S. Mohammed & Dr. HanP. Bao, Old Dominion University, Norfolk VA 23529. This abstract summarizes the challenges and solutions in coming up with a unified cost estimation model or in other words Enterprise wise cost modeling. Traditionally cost estimation methods and software have concentrated on obtaining the cost estimate for elemental parts and then adding the cost of all such parts that form the system. The problem with this is that the cost of systems engineering effort is not accounted for. Also factors such as uncertainty, maintainability, supply-chain, and socio-economic situation should be taken into account to effectively estimate cost of a system. A cost estimation hierarchy is set up as follows: Objective, Assembly, Product, System, and Program. The research goes beyond just cost of a system. The product domain is expanded from a simple object to a program which is several systems working in conjunction. The cost model caters to the needs of cost estimation at every stage. In the early stages at object level it suggests the user with applicable processes given the material and production quantity. Parametric cost estimation forms the backbone of this cost
model. Attributes such as materials, fabrication, processes, etc. are ontology based. This enables a generic category to branch into more and more specialized categories with each step. This is very useful since in the preliminary stages of cost estimation not much information is available as to what exact material or process is used. In such a case data pertaining to a more generalized material or process can be used. The ontology scheme is carried on to systems level also. Ontology at a systems level classifies common products into categories according to their functionality. This helps put together a system efficiently on paper; locate a product with a certain generic functionality and pull all necessary data to estimate cost. For storing and retrieving data XML is used. In order to deal with stochastic nature of the data collected fuzzy regression, stochastic regression, and Monte Carlo simulation are used. These tools are programmed using Matlab.