

a grant from the Dominion Foundation. Science Museum of Virginia is a center of informal science education, generally defined as “science teaching and learning that occurs outside of the formal school curriculum in places such as museums, the media, and community-based programs.” (NSTA Position Statement: Informal Science Education). The museum presents different content components in several forms of media focused on alternative and conventional energy sources. These include: a 2' x 3' original, detailed poster map of Virginia (*Energy Virginia*) showing sites of sources of energy and delivery mechanisms, including alternative and conventional sources. *Question Power* is an original six-minute video presenting the challenge of discovering clean, abundant energy sources. Eight one-minute videos display advantages and disadvantages of each of the major energy sources (wind, water, solar, geothermal, uranium, coal, oil, natural gas). The *Watt Wall* is a large computer-driven 100 square-foot display showing global energy demand and consumption. In addition, there is a K-12 Teacher Guide for these curriculum materials.

SERVICE LEARNING AND SUBSEQUENT COMMUNITY ENGAGEMENT IN A FIELD MAPPING CLASS. Dr Julia A. Nord, Atmospheric, Oceanic & Earth Sciences, & Dr Thomas C. Wood, New Century College. George Mason University. Fairfax, VA. Student feedback on experiential learning (EL) activities in a Mason, upper division Field Mapping Techniques course, provided insight in line with literature confirming the value of EL. This course was revised using service learning, and community learning pedagogies to improve student knowledge and affect domains. We surpass our traditional field oriented activities, provide services to the partners, and engage students through active learning projects and reflection. Teams create maps working with various techniques and equipment from GPS, GIS, and transits to pace-and-compass. All projects include field reconnaissance, mission planning, equipment check, data collection and processing followed by the creation of the map. The final project entails meeting with the Director of Environmental Studies on the Piedmont to discuss spatial information needs. Students design and develop projects that enable them to collect data and present usable maps and suggestions back to the Director. We utilize Kolb based EL to engage current, real world issues with repetitive, reflective practice. Students work at the upper levels of Bloom's revised Taxonomy and use at least seven of Gardner's multiple intelligences. We hypothesize, students will increase interest, capacity and ability to apply their knowledge and consequently improve. The NSF developed Student Assessment of Learning Gains instrument will measure these outcomes.

### Environmental Science

COMPARISON OF THE NI RIVER AND MASSAPONAX CREEK IN SPOTSYLVANIA, VA. D. Gutierrez, M. Recta, and M.L. Bass, Department of Earth and Environmental Sciences, UMW, Fredericksburg, VA 22401. The purpose of this research was to compare the water quality of the Ni River and Massaponax Creek, in Spotsylvania County. The Ni River is located in the more rural areas of the County while Massaponax Creek flows through more urbanized areas. Planned development of the Ni Village community will be occurring around the Ni River in the next few years and we expect the stream to be impacted like Massaponax Creek. Three different

sites were sampled along the Ni River and for Massaponax Creek. In order to determine the current water quality, parameters were measured both in the field and in the laboratory. Macroinvertebrate samples were gathered from each sampling site, then separated the aquatic insects into the orders: Ephemeroptera, Plecoptera, Trichoptera, Diptera, Megaloptera, Odonata, Coleoptera, and Miscellaneous. Using the macroinvertebrate data we measured %EPT and the Family Biotic Index. we measured parameters in the field such as Dissolved Oxygen, Temperature, Conductivity, and pH. Water samples were collected to analyze Nitrate, Phosphate, Ammonia, Alkalinity, and Hardness in the laboratory using LaMotte test kits. Water samples were also used to determine the Total Suspended Solids(TSS). Whirlpak bags were used to collect water at each site to determine the fecal coliform levels. The Phosphate, Nitrate, and Total Suspended Solids (TSS), pH, and fecal coliform levels are important EPA parameters for TMDL's. Our results showed that %EPT was higher in Massaponax Creek however; there was more variety of Ephemeroptera, Plecoptera, and Trichoptera in the Ni River. The order Trichoptera dominated the %EPT in Massaponax Creek and yielded a high percentage. The magnitude of the physical and chemical parameters measured in the field was not dramatic in either stream. Nitrate and Phosphate levels were found higher in the Ni River which is possibly due to the rural farms located around the stream. The TSS were found in higher amounts in the Massaponax Creek which may be caused by the urbanization. Fecal Coliform was found in high amounts at site 1 of Massaponax Creek but all other sites had lower levels. In conclusion, the urbanization around Massaponax Creek may have had a greater impact in the past; however the stream is recovering from stabilization of the riparian area along the stream. Further research will determine if the planned development around the Ni River will show the same pattern of impairment then recovery as Massaponax Creek.

RAIN GARDEN REMEDIATION EFFECTIVENESS OF TWO NATIVE PLANT SPECIES. Emma Wallace and Dr. Barbara B. Kreutzer; Marymount University. This study examined the effectiveness of *Panicum virgatum* and *Lobelia cardinalis* in reducing phosphate and nitrate levels in rainwater runoff. Both plant species are commonly implemented in rain gardens, landscaping tools that remediate rainwater runoff. Testing the phosphate and nitrate concentration in each pot-grown plant's leachate determined both species are similarly effective in reducing phosphate and nitrate levels.

SUMMARY OF WATER QUALITY ANALYSIS DATA FROM THE STORM WATER MANAGEMENT PONDS OF THE CENTRAL PARK DEVELOPMENT, FREDERICKSBURG, VA. M.L. Bass, M.Recta, and D. Gutierrez, Department of Earth and Environmental Sciences, UMW, Fredericksburg, VA 22401. The purpose of this research was to assess the impact of commercial and residential development on nearby streams.. The Chesapeake Bay area is undergoing policy change in which there will be stricter regulations on the amount of material that can be emptied into the Bay. Limits on the Total Maximum Daily Load (TMDL) will cause the Chesapeake Bay community to be more conscious of land management practices. The area of study during the summer of 2011 included 6 sampling stations on England Run and an unnamed tributary that have been affected by the construction of Celebrate Virginia North located in Stafford County, Virginia. Methodology for the water quality study

includes on-site field water quality analysis using YSI models 85 and YSI ProPlus meters that measured temperature, dissolved oxygen, conductivity, ammonia, nitrate, and pH. Water samples were analyzed for levels of nitrate, phosphate, hardness, ammonia, and alkalinity using LaMotte test kits. Total suspended solids (TSS) were also studied to determine the impact of construction causing an increase in sedimentation and turbidity. Fecal coliform presence was determined. Water quality analysis showed that the levels of nitrates, phosphates, TSS, and fecal coliform were below EPA standards. In addition, the macrobenthic community was also studied. The insects sampled within the stream were identified and analyzed using various biological community evaluation metrics such as percent Ephemeroptera Plecoptera Trichoptera (%EPT), Family Biotic Index (FBI), and Hilsenhoff Biotic Index (HBI) that indicate the health of the stream based on the ratios of pollution sensitive to pollution tolerant insects within a given sampling station. The data collected during the summer of 2011 was compared to baseline data from the pre-development and early development stages of Celebrate Virginia North. During the early development stages of the Celebrate Virginia North project, many of the ecological habitats were negatively impacted by the development. Recent research using the biological assessment of the streams shows that the macrobenthic community is showing improvement as a result of stabilization with vegetation of previously scoured and erosion-prone areas. Further research continues in order to determine the impact of development on these streams.

OYSTER RESTORATION AND WATER QUALITY ANALYSIS IN AN URBAN SUB-ESTUARY. Melinda Hopper<sup>1</sup>, Matthew Boyce, and Maury Howard. Chemistry Dept., Virginia Wesleyan College. This study was conducted to monitor a local body of water and to determine the effect of oysters on water quality. The purpose is to determine whether oyster restoration can help the quality of the water and whether this site is an ideal location for restoration. Water samples were collected over a year long period at 3 different sites. Each sample was tested for various water quality indicators, including chlorophyll a, total phosphorus, temperature, pH, BOD and salinity. Sediment samples and oyster tissue samples were also collected and run through an ICP-MS to identify the toxic metals found within them. High concentrations of lead, mercury, arsenic, and other heavy metals were some of the main components. The water contained very low levels of metals due to the tidal influence. However, the sediments and oyster tissue contained high concentrations of many of them, showing the effects of bioaccumulation. It also shows the value of the oysters as filters for the system, removing toxins and nutrients from the ecosystem.

ORGANOPHOSPHATE PESTICIDE CONCENTRATIONS IN TOMATOES FROM THE HARRISONBURG AREA. K. Åkerson<sup>1</sup> and Doug G. Neufeld, Dept. of Biology, Eastern Mennonite University. We wanted to combine an extraction method and a detection assay, and to discover the pesticide concentration difference between large farm and small farm organic tomatoes. First, the QuEChERS extraction method and enzyme-based detection assay was combined to successfully detect organophosphates/carbamate pesticides (OP/C) at concentration levels of at least one part per billion (ppb) or greater. From this, we concluded that QuEChERS and the

enzyme-based assay work in combination, and even reproduce precise results at an average 19.4% relative percent difference (RPD). Second, because OP/C causes harmful health effects at high doses, we investigated pesticide concentration of farmers' market tomatoes compared to supermarket tomatoes. Our results suggested OP/C in three samples: 2 out of 10 farmers' market tomato samples and 1 out of 5 supermarket tomato samples. The detection of OP/C surprised us, though, because locations claimed organic production. One explanation of this could be that sources other than the farmers contaminated the samples.

### Medical Science

$\alpha 7$  nAChR NEGATIVE ALLOSTERISM: A PROMISING APPROACH FOR COGNITIVE DISORDERS. O. I. Alwassil<sup>1</sup>, G. Abdrakhmanova<sup>2</sup>, and M. Dukat<sup>1</sup>, <sup>1</sup>Department of Medicinal Chemistry and <sup>2</sup>Department of Pharmacology & Toxicology, Virginia Commonwealth University, Richmond VA 23298. Progression of Alzheimer's disease (AD) is associated with an increase of  $\beta$ -amyloid peptide 1-42 ( $A\beta_{1-42}$ ) neurotoxic interactions with  $\alpha 7$  neuronal nicotinic acetylcholine receptors (nAChRs) leading to tau protein hyperphosphorylation and neuron deficit. Through their neuroprotective abilities against toxic  $\alpha 7$  nAChR- $A\beta_{1-42}$  interactions,  $\alpha 7$  nAChR ligands might represent promising targets for AD symptomatic therapy. We have identified *meta*-chlorophenylguanidine (*m*CPG;  $IC_{50} = 8.0 \mu M$ ) as the first small-molecule negative allosteric modulator (NAM) at  $\alpha 7$  nAChRs. *m*CPG might serve as a lead in developing structure-activity relationships for NAMs at  $\alpha 7$  nAChRs. Several analogs of *m*CPG were synthesized and evaluated in whole-cell patch-clamp assay. Introduction of a methyl group on the aniline nitrogen atom of *m*CPG resulted in a more potent  $\alpha 7$  NAM ( $IC_{50} = 1.3 \mu M$ ) than *m*CPG. Since the exact interaction site(s) and mechanism by which the  $\alpha 7$  nAChR NAMs work has not been yet fully described, we developed 3D models of the extracellular domain (ECD) of human MBOL97\ "Symbol" s107 nAChRs. Modeling studies resulted in the identification of two out of five binding sites in the ECD that are supported by empirical data. The different docking solutions are consistent with functional data. *Supported in part by the Virginia Center on Aging (Award No. 12-2).*

THE INTERACTION BETWEEN WIN55,212-2 AND RADIATION ON INHIBITING THE GROWTH OF BREAST CANCER CELLS. S. M. Emery<sup>1</sup>, E. T. Sumner, Q. Tao, A. H. Lichtman & D. A. Gewirtz<sup>1</sup>, <sup>1</sup>Department of Pharmacology and Toxicology, Virginia Commonwealth University, Richmond VA 23298. Win55,212-2 (WIN2) is classified as a full agonist for cannabinoid receptors CB1 and CB2, as well as an agonist for known off targets of the endocannabinoid system including TRPV1 and PPAR $\alpha$ - $\gamma$ . Recent reports have shown that WIN2 has anti-proliferative effects on cancer, but no studies have been performed to evaluate potential interactions between WIN2 and ionizing radiation (IR) used in cancer treatment. We have shown that WIN2 has the capacity to significantly enhance the anti-proliferative effects of IR in the MCF-7 breast tumor cell line. This effect has been reproduced in MDA-MB-231 and 4T1