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Proceedings of the West Virginia
Academy of Science
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Vol.83, No. 1

Table of Contents

ORAL PRESENTATIONS

BOTANY/ZOOLOGY/MICROBIOLOGY

ECOLOGY/ENVIRONMENTAL SCIENCE

CHEMISTRY/PHYSICS

MATHEMATICS/COMPUTER SCIENCE/ENGINEERING

EARTH SCIENCES

POSTER PRESENTATIONS

BOTANY/ZOOLOGY/MICROBIOLOGY

ECOLOGY/ENVIRONMENTAL SCIENCE

BIOCHEMISTRY/HEALTH SCIENCES

MATHEMATICS/COMPUTER SCIENCE/ENGINEERING

EARTH SCIENCES

SOCIAL SCIENCES/SCIENCE EDUCATION

ORAL PRESENTATIONS

Botany/Zoology/Microbiology

JEREMY ARTHUR, TIM RUHNKE, and ELAINE HENSLEY, Dept. of Biology, West Virginia State University, Institute, WV 25112.
Molecular and morphological systematics of the tapeworm genus *Anthocephalum*.

The genus *Anthocephalum* was erected by Southwell (1925) for tapeworms taken from the roughtail stingray, *Dasyatis centroura*, and currently houses nine species. Species of the genus are most distinctively characterized by the marginally loculate morphology of their scolex bothridia in addition to the possession of a genital pore located in the posterior half of the proglottid and a sinuous vagina. Review of collections of *Anthocephalum* from dasyatid hosts of the genera *Dasyatis, Himantua*, and *Taeniura* have so far revealed a number of new species of the genus. Sequencing of the ND1 gene region of ND1 mtDNA revealed eight genetically distinct samples of *Anthocephalum*. Sequencing of the nuclear lsr DNA was consistent with the ND1 data, and many individuals of three of the new species were verified. These new species have been taken from stingray hosts from the following localities: northern Australia, Malaysian Borneo, and coastal Senegal. Scanning electron microscopy of three of the new species revealed that the distribution of microtriches on their scolices is similar to those for existing species. These new species can be differentiated from one another and from existing species of *Anthocephalum* in characteristics such as total length, apical sucker diameter, marginal loculi number, proglottid dimensions and testes number. Additional PRC and DNA sequencing of lsrDNA and COX1 mtDNA of the new and existing species of *Anthocephalum* is ongoing.

The work is supported by NSF-BS&I (DEB No. 9300796), NSF-PEET (DEB No. 0118882), and WV-NASA.

PETE HUNT and TIM RUHNKE, Dept. of Biology, West Virginia State University, Institute, WV 25112, and JANINE CAIRA, Dept. of Ecology and Evolutionary Biology, The University of Connecticut. **Molecular systematic investigations into a strange cestode collected from the pelagic thresher shark.**

Tapeworm collections from the pelagic thresher shark, *Alopias pelagicus*, collected from the Gulf of California, revealed a cestode unlike any other taxon in existence. As opposed to having bothria, bothridia, or suckers associated with its scolex, the scolex of this new species is mushroom in shape. This cestode is strobilate but does not appear to be proglottized. The cestode also has organs of unknown function associated with tissue posterior to the "mushroom". Previous sequencing of nuclear ribosomal DNA (lsrDNA) revealed that this taxon was closely related to two species of the genus *Litobothrium*. This latter genus is also parasitic in host sharks of the genus *Alopias*, as well as being an oddity in terms of its morphology. The purpose of this research is to compare additional species of *Litobothrium* in order to determine whether the new taxon is phylogenetically distinct from species in it. So far, the D1-D3 region of lsrDNA has been sequenced for three additional samples of *Litobothrium*. Analysis of lsrDNA does not provide evidence for the monophyly of *Litobothrium* relative to the new cestode.

The research was supported by NSF EPSCoR RII, NSF-BS&I (DEB No. 9300796), and WV-NASA.

T. JEWELL and C.Z. PLAUTZ, Dept. of Biology, Shepherd University, Shepherdstown, WV 25443. **Using gynogenesis to identify novel phenotypes in a random mutagenesis screening of *Xenopus tropicalis*.**

The Western clawed frog *Xenopus tropicalis* is a very useful organism for genetic screening, possessing advantages, such as a diploid genome and rapid generation time; additionally, the closely related *X. laevis* has been used to elucidate many developmental mechanisms. One method of uncovering novel recessive mutations is cold-shock-induced gynogenesis. Females of the F1 generation of randomly mutagenized *X. tropicalis* were used to produce haploid embryos. Gynogenetic embryos were produced by inhibiting the completion of meiosis in these haploids; the resulting diploids thus bear two copies of the maternal genome. We uncovered and described three novel developmental mutant phenotypes. Characterizing these phenotypes is an important first step in identifying and cloning the genes responsible. This work thus adds to the burgeoning body of knowledge about the *Xenopus tropicalis* genome.

CAMERON LEWIS and TIM RUHNKE. Dept. of Biology, West Virginia State University, Institute, WV 25112. **Molecular systematics of the tapeworm genus *Paraorygmatobothrium*.**

Species of the cestode genus *Paraorygmatobothrium* are parasites in a number of sharks of the order Carcharhiniformes. Turner (2006) focused on the phylogenetic relationships of *Paraorygmatobothrium* species from 16 carcharhiniform species. In an analysis of the first half of cytochrome c oxidase subunit 1 (COX1), she found that samples of *Paraorygmatobothrium* from the cosmopolitan blacktip shark, *Carcharhinus limbatus*, were not monophyletic, but were a complex of up to five non-monophyletic species. Recently, we have focused on studying samples of *Paraorygmatobothrium* from the geographically widespread shark species *Rhizoprionodon acutus*. COX1 sequence has been generated for samples of *Paraorygmatobothrium* from five individuals of *R. acutus*, in addition to six samples from four other carcharhiniform shark species. PCR and sequencing of additional samples is ongoing. Sequences will be aligned to the COX1 phylogenetic database for species of Paraorygmatobothrium in order to test whether samples (or species) of *Paraorygmatobothrium* from *Rhizoprionodon acutus* are in fact monophyletic.

The work was supported by NSF-REU, NSF-BS&I (DEB No. 0103640), NSF-PEET (DEB No. 0118882) and WV-NASA.

ANDREA RENSHAW and DR. ROGER SEEBER JR., Dept. of Biology, West Liberty University, West Liberty, WV 26074. **A comparison of the viability of tomato seeds (*Lycopersicon* spp) in dry storage and at -20 °C.**

The West Liberty Tomato Genetics Preservation project preserves the genetic lineages of heirloom and donated species of tomatoes. The project is currently preserving over 700 varieties of heirloom tomatoes by dry storage. In an attempt to back up this storage technique, starting several years ago approximately half of the seeds collected each fall were frozen at -20 °C. This study did trials on the germination rates of seeds that had been placed in a standard freezer in contrast to those in dry storage. It is a commonly accepted belief that freezing tomato seeds without proper desiccation would lead to ice-crystal formation, negatively affecting their germination rates. In order to test this premise, seeds that had been stored at -20 °C were put into 9-cm Petri

dishes with two sheets of Whatman #1 filter paper. Twenty-five seeds were placed on the filter paper. Five milliliters of water was used to moisten the filter paper. Due to the limited number of seeds available, only two dishes were prepared for each seed variety. The number of seeds germinated was recorded for each dish. Some varieties were not used in the trials because of very low numbers of seeds in some of the storage bags.

It has been determined that freezing does not affect the germination rate of these tomato seeds as adversely as commonly thought. There was no major difference between the germination rates of the seeds in frozen versus dry storage. Therefore, it has been determined that using the freezer for tomato seed storage is a useful option.

JENNIFER WEIDHAAS, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506, TAMZEN MACBETH and ROGER OLSEN, CDM, Denver, CO, and VALERIE J HARWOOD, Dept. of Integrative Biology, University of South Florida, Tampa, FL. **Identification of a poultry-litter-specific *Brevibacterium* marker gene and correlation of the marker gene with bacterial and chemical indicators in a poultry-litter-impacted watershed.**

The impact of fecal contamination from human and animal waste on water quality is a major public health concern. Identification of the dominant source(s) of fecal pollution in a watershed is necessary for protecting water resources. Rapid methods to identify the source of impairment in water bodies are sought by regulatory agencies and water quality managers. Microbial source tracking (MST) using quantitative PCR methods can detect marker genes in the environment and provide evidence that the receiving water has been impacted by a specific animal's fecal material. We developed an MST method specific for poultry litter and tested for the marker gene in a large watershed that is impacted by poultry litter. We found the marker gene in high concentrations in all 17 litter samples tested from commercial meat poultry operations. The poultry litter marker gene was found in feces from non-commercially grown poultry from Georgia, Florida, Utah, and Minnesota. The poultry litter marker gene is highly specific as it was detected in only eight of 116 non-target fecal samples. We found that the marker gene was detected in water and soil samples collected throughout our study area (Illinois River watershed) and displayed a declining trend with distance from the source of the marker. Additionally the marker gene's concentration co-varied with concentrations of *Escherichia coli*, other fecal coliforms, enterococci, As, Cu, P, and Zn in environmental samples. Recent testing in West Virginia indicates that this poultry liter marker gene may be useful in the Potomac River watershed for tracking poultry litter releases to water.

CARRIE WHITAKER, Institute for Environmental Studies, Shepherd University, Shepherdstown, WV 25443, and DENNIS BENNETT, JR., and DR. ZONGRANG LIU, USDA-ARS Appalachian Fruit Research Station, Kearneysville, WV 25430. **Comparison between methylation types among transgenic and endogenous *Arabidopsis thaliana* DNA fragments in transgenic genomes.**

Cytosine methylation is a component of the epigenetic system that has been associated with genetic expression, cell differentiation, and stimuli response. This covalent bonding of the chromatin compresses the structure, controlling RNA access to the DNA contained within. This epigenetic attribute is especially complicated in flowering plants since it has been found to cooperate with and depend on several other epigenetic forces, making

it difficult to determine which factors are integral at specific stages of development and in specific environmental contexts. Recent genetic experimentation that has explored the effects of introducing foreign genetic material into genomes has indicated some specific functions of cytosine methylation as a regulatory factor. To test whether differing levels of methylation could be found among three known plant methylation site types in endogenous versus transgenic loci, similarly mutated double flowering *Arabidopsis thaliana* plants were examined. DNA fragments from each plant were extracted, converted with bisulfite, and sequenced to reveal frequency of cytosine methylation between methylation types among these two gene fragment types. Highly significant statistical differences were detected between endogenous and transgenic sequences in all three cases, with overall higher levels of methylation occurring in the transgenic sequences. In future investigations, we hope to determine whether an overall pattern of cytosine methylation can be detected, which may indicate relative health of plants and/or provide a mechanism by which to influence expression and correct reversible epigenetic marking.

Ecology/EnvironmentalScience

HASSAN AMJAD, M.D., FLS, Jafary Medical Clinics, 166 George Street, Beckley, West Virginia 25801, and QUARTEL-AYNE AMJAD, M.D., MPH, Beckley, West Virginia 25801. ***Franklinia alatamha*, an American medicinal tea plant.**

Franklinia alatamha is a small tree of historical significance and has been extinct from the wild for nearly 200 hundred years. All current trees are cultivated plants derived from the original seeds brought to Philadelphia by Bartram. Dried leaves when chewed have a strong astringent taste similar to green tea, *Camellia sinensis*, which led to our search for catechins.

Objective: To detect and quantify catechins, xanthines, theophylline, and theaflavins in leaf extracts.

Methods: Powdered leaf extract was subjected to HP-TLC; bands were detected after vanillin-sulfuric acid application. Further analysis was done with Agilent HPLC system with DAD-mobile phase methanol-acetonitrile followed by LC-MS analysis.

Results: catechins (0.35%), epicatechins (0.51%), epigallocatechins (EC, 0.33%), epigallocatechin gallate (ECG, 0.1%), caffeine (0.18%), theophylline (0.02%), theobromine (0.006%), theofalvin (0.05%). LC-MS analysis of leaves was done by mass spectrometer using electroscopy ionization (ES) in negative mode. MS infusion analysis for molecular weights of known compounds indicated epicatechin and epicatechin gallate were present. The sample gave strong signals at m/z 291 and 443; comparison with the literature indicates the compounds found in the *Franklinia* leaves are EC and ECG.

Conclusions: *Franklinia* tree is an American tea plant and its leaves contain catechins similar to green tea but without caffeine. These polyphenolic compounds are known antioxidants and free radical scavengers. Therefore *Franklinia* should show health benefits similar to green tea.

DEBORAH K. BEUTLER, CAYTE VIGILANTE, ESTHER PLYMALE, and ASHTON STAUNTON, Dept. of Biology, West Virginia University Institute of Technology, Montgomery, WV 25136. **The effects of the outflow from acid mine drainage settling ponds on the pH of Morris Creek, WV.**

In March 2009 we began to test the efficiency of the upper mainstem (UM) and lower mainstem (LM) passive treatment ponds created to neutralize acid mine drainage (AMD) from abandoned coal mines in the Morris Creek Watershed, Kanawha and Fayette Counties, West Virginia. Each set of ponds consisted of five ponds lined with limestone; one pond in LM had a small wetland. We used a digital pH meter to determine the pH of the inflow from the mountain, the outflow of the pond, and the stream above and below the outflow. At the start, both UM and LM raised the pH of the AMD. The mountain inflow pH was 3.4 and the outflow from the UM was 5.7. The creek showed signs of improvement in substrate color (brown instead of orange) and the presence of macroinvertebrates. Our data show that the effectiveness of the ponds has decreased over last two years; the UM failed even though it was only three years old and the LM is failing after five years. Currently, the mountain inflow to the upper mainstem ponds has a pH of 3.41 and the outflow from the ponds is 3.46. The lower mainstem is slightly more efficient with an inflow pH of 4.5 and an outflow of 5.7. Reduced efficiency of the ponds resulted in lower creek pH, particularly at the UM, and a return of the orange color to the streambed.

EMILY BOSLEY and MARK FLOOD, Dept. of Biology, Fairmont State University, Fairmont, WV 26554, and EMILY PERROTTA and PAUL BAKER, Save the Tygart Watershed Association, Grafton, WV 26354. **Measuring the effectiveness of acid mine drainage remediation in tributaries of Three Fork Creek.**

Acid Mine Drainage (AMD) is the term used to describe the overflow from abandoned coal mines into surrounding streams. AMD often contains high levels of sulfuric acid, which makes the water acidic. The low pH is directly harmful to aquatic organisms and also facilitates large quantities of metals becoming dissolved, which also negatively affect aquatic organisms.

One of the standard ways to treat AMD is to add limestone in a controlled manner, which will raise the pH to an acceptable level. The objective of this project was to collect stream quality data for Three Fork Creek and several tributaries that are impacted by AMD and to determine how remediation modifies stream quality. Stream quality was assessed using several factors, including pH, total dissolved solids, suspended solids, conductivity, turbidity, acidity, alkalinity, dissolved oxygen, temperature, fecal coliforms, dissolved metals (iron, aluminum, and manganese), and benthic macroinvertebrates for a total of 12 sites along the Three Fork Creek Drainage. Results obtained so far indicate that three of the tributaries of Three Fork Creek are greatly impacted by AMD and two others are not. As expected, several parameters varied considerably with different flow rates. Limestone dosers are currently being installed on the three affected tributaries, and future stream quality measurements will be taken in order to monitor the impact of remediation on the Three Fork Creek watershed.

Support for this project was provided by a Fairmont State University NASA Summer Undergraduate Research Fellowship and by Save the Tygart Watershed Association.

ESTHER T. CASTELLO-PLYMALE, DEBORAH BEUTLER, ASHTON STAUNTON, and CAYTE VIGILANTE, Dept. of Biology, West Virginia University Institute of Technology, Montgomery, WV 25136. **The effects of acid mine drainage on macroinvertebrate population in Morris Creek, WV using mayflies, caddisflies, and stoneflies as a bioassessment tool.**

In March 2009 we began taking macroinvertebrate samples from Morris Creek, WV. Our samples consist of data collected above and below inflows of the acid mine drainage (AMD) settling ponds. We measured pH and dissolved oxygen levels in addition to collecting the macroinvertebrate samples. All samples were obtained every five meters starting at 20 m below the inflow and moving upstream to 20 m above the inflow. We used a one-square-meter kicknet to collect debris from a one-meter-square quadrat. Water samples were also taken at each sample station. The pH at the upper mainstem pond was significantly lower at the inflow than above the inflow. It was found that species diversity was lower below the inflow than above, and furthermore no mayflies at all were found below the inflow. Dissolved oxygen remained at healthy, life-supporting levels at all locations sampled and therefore was not considered to be a limiting factor. At the lower mainstem pond pH remained at near-neutral levels. Species richness and diversity were not changed below the inflow relative to above. It was concluded that pH levels can significantly affect the richness of a population of organisms.

JESSICA CURTIS and PETER VILA, Dept. of Environmental Studies, Shepherd University, Shepherdstown, WV 25443. **Ecology of wood turtles in Sleepy Creek Wildlife Management Area.**

The objective of this study is to determine population viability, home range size, and potential risks to the population of the wood turtle *(Clemmys insculpta)* in Meadow Branch, located in the Sleepy Creek Wildlife Management Area (SCWMA). This study was conducted from May to October 2010. Twenty-one turtles were captured and marked with shell notches: 11 males, 8 females, and 2 juveniles. Ten adult turtles were fitted with radio transmitters. There were 171 total captures, of which 15 were made without radio telemetry. Preliminary data indicates that the wood turtle population in SCWMA is morphometrically similar to populations in other areas of WV. Home range sizes are small (0.43-2.49 ha), but normal for the species in this region. The population sex ratio did not differ significantly from a 1:1 ratio. Wood turtles were found in four areas clustered around the permanent pools along Meadow Branch. Because of low capture rates, long-term viability of the population requires further study.

JASON D. DAVIS and SEAN A. COLLINS, Dept. of Biology, West Virginia State University, Institute, WV 25112. **New microsatellite markers for salamanders in the genus *Ambystoma*.**

Microsatellites (also known as simple sequence repeats (SSRs), or short tandem repeats (STRs)) are short, single locus motifs of DNA (typically from two to six bases) that are repeated many times. They tend to occur in non-coding regions, and thus are not typically subject to natural selection and therefore tend to be quite variable between unrelated individuals.

The Ambystomatidae (commonly referred to as mole salamanders) are a very widespread and well-studied family of salamanders. To date, microsatellite markers have been identified from several species in the genus *Ambystoma* (*A. macrodactylum, A. jeffersonanium, A. texanum,* and *A. tigrinum*, to name a few). We are currently embarking on a project to determine the movement patterns and genetic structure of *A. maculatum*, the spotted salamander, in the Kanawha Valley of West Virginia and have identified several novel microsatellites for this species to enable us to pursue this project. Whole genomic DNA was extracted from the tails of candidate specimens of *A. tigrinum* and *A. maculatum*, and

microsatellite loci were isolated and identified using a modified protocol of the microsatellite capture method (Kandpal et al. 1994; Brown et al. 1995; Prochazka 1996). This method uses microsatellite probes attached to magnetic beads to isolate fragments of DNA containing microsatellites. Because of the degree of genetic similarity across this family, we are very confident that these markers will be of use for studies of other species in the genus.

SARA DAVIS and PETER VILA, Institute of Environmental Studies, Shepherd University, Shepherdstown, WV 25443. **Effects of wavyleaf basketgrass *(Oplismenus hirtellus ssp. undulatifolius)* on native herbaceous plant communities in Shenandoah National Park.**

Wavyleaf basketgrass *(Oplismenus hirtellus ssp. undulatifolius)* is an invasive species found in Virginia and Maryland since 2005. Wavyleaf basketgrass is shade-tolerant, flourishes on the forest floor, and its sticky seeds allow for dispersal over large areas. This study assesses the impact wavyleaf basketgrass has on other herbaceous plant species on the forest floor. Five paired plots were set up at Swift Run, Shenandoah National Park. Each pair had a treatment plot where wavyleaf basketgrass was removed by handpulling and a control plot where no removal was done. Variables recorded were species richness and percent cover. While species richness was significantly negatively correlated with basketgrass, percent cover was not affected over the six weeks of the sampling period. Due to the strong impacts of wavyleaf basketgrass on native herbaceous plants, this study suggests that wavyleaf basketgrass should be assessed to identify impacts on other native flora and fauna.

RAQUEL FAGUNDO, NATE TAYLOR, DAVID FOLTZ II, TRICIA KANGISSER, NICOLE GARRISON, ANDREA RENSHAW, and ZACHARY LOUGHMAN, Dept. of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074, and STUART WELSH, West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University, Morgantown, WV 26506-6125. **Epigean crayfishes of West Virginia's lower Kanawha River system: conservation and natural history.**

The Lower Kanawha River system's epigean crayfish fauna was surveyed during the summer of 2010. Goals of this project included determining the native fauna of the basin and identification of conservation concerns. Thirty-seven random sites were chosen for sampling through the use of GIS. Site coverage accounted for all stream orders conducive to crayfishes. Physiochemical and biotic data were collected at each site, as well as crayfish vouchers for identification in the laboratory. The native fauna of the Lower Kanawha River system consists of three species: *Cambarus b. cavatus*, *Cambarus robustus*, and *Orconectes sanbornii*. The invasive crayfish, *Orconectes virilis*, was collected in every sub-basin within the system. This species has competitively excluded crayfishes in other West Virginia basins and represents the most important conservation concern in the Lower Kanawha River system. Siltation associated with development and agriculture is another imporant cause of imperilment. Crayfish conservation efforts in the Lower Kanawha should focus on limiting the expansion of *O. virlis* and controlling siltation impacts throughout the basin.

LESLIE HOPKINSON, Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506 and THERESA WYNN, Biological Systems Engineering, Virginia Tech, Blacksburg, VA 24061.

Reach-scale influence of riparian vegetation on headwater channel morphology.

A strong link exists between riparian vegetation and channel morphology. Small streams (watershed area < 100 km^2) with forested riparian vegetation are significantly wider than similar streams with herbaceous riparian vegetation. Additionally, channels with grass vegetation migrate at a greater rate than similar forested channels. This study examined the role of riparian vegetation form on the hydraulic forces applied to the stream bank. A second order stream was modeled in a scaled flume experiment with no vegetation, woody vegetation, and grass on the sloping stream banks. Near-bank velocity was measured with an acoustic Doppler velocimeter, and stream bank boundary shear stress was measured with a constant temperature anemometer. The presence of above-ground vegetation on the stream banks increased the hydraulic resistance and altered both the flow and turbulence patterns in the channel. Dense stream bank vegetation created a zone of uniform velocity adjacent to the stream bank and an area of increased turbulence at the interface between the vegetation and the main channel. Compared to the bare channel, the flexible herbaceous vegetation folded and reduced shear stress near the boundary. In contrast, the rigid woody vegetation increased shear stress near the stream bank, particularly at the stream bank toe suggesting that semi-rigid vegetation may encourage the formation of a wider channel. Through multiple complex interactions between these applied forces and the erosion resistance provided by the soil and root distribution, riparian vegetation exerts significant control on headwater stream form. Increased understanding of the interactions between stream channel morphology and riparian vegetation is needed to guide stream management and restoration decision-making.

ZACHARY LOUGHMAN Dept. of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074, Dept. of Biology, Indiana State University, Terre Haute, IN 47801, and STUART WELSH, West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University, Morgantown WV 26506-6125. ***Cambarus (Puncticambarus) smilax*, a new species of crayfish (Crustacea; Decapoda: Cambaridae) from the Greenbrier River basin of West Virginia.**

Cambarus (Puncticambarus) smilax is a stream-dwelling crayfish endemic to the Greenbrier River basin in the Valley and Ridge province of West Virginia. Within the Greenbrier system, *C.* (*P.*) *smilax* occurs primarily in tributaries to the Greenbrier mainstem, with stable populations in the East and West Fork, and Thorny, Knapp, and Deer creeks. The new species is morphologically most similar to *C.*(*P.*) *robustus*, from which it can be distinguished by a combination of the following characteristics: adult palm length comprising 73–76 percent of palm width as opposed to 63–70 percent in *C.*(*P.*) *robustus*; ventral surface of chela of cheliped with 0–2 subpalmer tubercles compared to 3–6 subpalmer tubercles in *C.*(*P.*) *robustus*; lack of tubercles on the dorsal surface of chelae; longer, more tapering, less rectangular rostrum (47–52% rostrum width/length ratio) compared to *C.* (*P.*) *robustus* shorter, less tapering rectangular rostrum (54–63% rostrum width/length ratio); and the central projection of the form-I male gonopod curved ≤ 90 degrees to the shaft. Within the Greenbrier River system *C.*(*P.*) smilax is currently stable. Practices needed to maintain this conservation status are discussed.

KIMBERLY LYONS and PETER VILA, Institute of Environmental Studies, Shepherd University, Shepherdstown, WV 25443. **Assessment of remediation on water quality**

of streams in the Buffalo Creek watershed, WV: comparison of eleven water quality parameters between 1999 and 2010.

In 1977 the Surface Mining Control and Reclamation Act (SMCRA) and the Clean Water Act (CWA) were passed to regulate discharge and mining practices. While these acts have resulted in many studies related to stream ecology, most have been short term studies, and longer term studies are necessary for monitoring lasting improvement to stream ecosystems. The Buffalo Creek watershed in Marion county West Virginia drains 125 square acres of land and runs through heavily mined high- sulfur coal, resulting in acid mine drainage (AMD). Waters impacted by AMD are characterized by an increase in metal ion concentrations and low pH levels. The objective of this study was to assess the results of water quality improvements in the Buffalo Creek watershed between 1999 and 2010. Data from 1999 were obtained from the West Virginia Dept. of Environmental Protection database; 2010 data were determined by field samples. Eleven water quality parameters were evaluated. A Mann-Whitney *U* test revealed no significant differences in total suspended solids, pH, sulfate, total manganese, dissolved oxygen, and temperature values, indicating stable levels for these parameters. However, conductivity, total magnesium, and total calcium, decreased over the ten years while total aluminum and total iron increased. This indicates that the stream is still affected by external inputs. These effects need to be monitored more often than decadal surveys in order to determine the remediation dynamics and to identify the sources of impairment.

CHRISTINA SCHRECKENGOST[1], DR. MILAN VAVREK[2], and DR. SARA SAWYER[1] [1]Science and Mathematics Dept., Glenville State College, Glenville, WV. [2]Dept. of Land Resources, Glenville State College, Glenville, WV. **Effect of *Ailanthus altissima* on a soil macroinvertebrate community.**

Ailanthus altissima, tree-of-heaven, is an invasive species that's becoming a dominant species in disturbed areas. We examined the effect of *A. altissima* on the soil macroinvertebrate community of a hardwood forest (Glenville, WV). In a previous experiment, we showed that *A. altissima* leaf litter had little effect on abundance or richness of soil macroinvertebrates except for members of the orders Collembola and Isopoda. These orders showed increased abundance in soil with *A. altissima* ($p<0.05$). This suggests that leaf litter from *A. altissima* does not have the insecticidal properties of fresh leaves. To determine if the presence of *A. altissima* itself affects the soil macroinvertebrate community, we compared macroinvertebrate abundance and richness in forest edge areas with and without *A. altissima*. The results from this study showed that overall richness and abundance of macroinvertebrates was the same in areas with and without *A. altissima*. However there was an increase in abundance of insects from the orders of Isoptera, Orthoptera, and Hemiptera in areas with native species compared to areas with tree-of-heaven. In areas where *A. altissima* was present, there was an increase of abundance of insects from the orders Hymenoptera and Coleoptera. These findings suggest *A. altissima* would see reduced grazing pressure and potentially increased soil quality compared to native tree species. These factors could give *A. altissima* an advantage over native species in becoming established in an area. Future studies will investigate the effect of *A. altissima* has on soil microinvertebrate community structure.

GARY D. THOMPSON and THOMAS B. FORD, Dept. of Biology, Concord University, Athens, WV 24712.

Assessment of passive treatments of a stream impacted by acid mine drainage.

Acid mine drainage within WV is a widespread and persistent problem to humans and wildlife. Common practices of remediation in WV utilize passive treatments to mitigate pollution. To assess the effectiveness of these treatments, one AMD stream (Morris Creek) and one non-AMD stream (Davis Creek) were analyzed for various water chemistry parameters, such as heavy metals, conductivity, and pH. Assessments of the macroinvertebrate communities were also performed for both streams. AMD stream ranged from 243.1 to 1092.3 µS/cm for conductivity and 3.47 to 8.28 for pH. Non-AMD stream ranged from 66.9 to 81.3 µS/cm for conductivity and 7.55 to 8.13 for pH. The AMD stream contained fewer pollution-sensitive macroinvertebrate taxa compared to the non-AMD stream. These results suggest that AMD within the Morris Creek watershed is not being successfully mitigated by passive treatment.

This research was supported by the Concord University Biology Dept. and the McNair Scholar Program.

KRISTEN TREVEY, CARA SCHILDTKNECHT, and PETER VILA, Dept. of Environmental Science, and DAN DILELLA Dept. of Chemistry, Shepherd University, Shepherdstown, WV 25430. **Preliminary assessment of water quality and nutrient load in springs and streams of Jefferson County, West Virginia.**

Twelve streams and six springs were sampled monthly in 2010 for water quality and quantity in Jefferson County, WV. Four streams drain into the Potomac River and eight streams drain into the Shenandoah River. Physical parameters included temperature, turbidity, specific conductivity, pH, and dissolved oxygen. All values were typical from streams underlain by karst and metamorphic geology. *E.coli* levels at spring karst sites were consistently low; values exceeded EPA 409 CFU/100 mL levels for lightly used waters with full-body contact only once in two sites. Mainstem sites in karst areas exceeded EPA limits two to six times over the sampling period. Although fluoride, chloride, nitrite, nitrate, sulfate, and phosphate concentrations were determined, only chloride, nitrate, and sulfate were present consistently in detectable amounts. Nitrate is especially important as a major contributor to eutrophication in the Chesapeake Bay and is a target for TMDL reductions across the bay's watershed. Nitrate concentrations ranged from 5.2 to 40.7 mg/L in springs and mainstem sites. Nitrogen loads at the mouths of the 12 tributaries sampled of the two rivers being studied ranged from 9 to 110 tons/yr. of nitrate-N. Total nitrate-N at the mouths of the two main rivers was 243 tons/yr. Nutrient determination was made at baseflow. Given that baseflow nutrient levels are essentially groundwater inputs, total load will require determination of nutrient levels during storm hydrographs. These stormflow determinations will provide the level of reduction possible with the implementation of best management practices (BMP) or other regulatory mandates. In addition, nutrient budgets are essential to determine the efficacy and cost benefit of any BMP, wastewater treatment plant renovation, or stormwater management.

Chemistry/Physics

DUSTIN REVELL, Dept. of Biology, Shepherd University, Shepherdstown, WV 25433, and ELIZABETH MADDOX, Dept. of Computer Science, Mathematics and Engineering,

Shepherd University, Shepherdstown, WV 25433. **Applications and experimental results of Newton's law of heating and cooling.**

In a world troubled by high crime rates and seemingly insane psychopaths frequently killing people, forensic scientists and detectives, such as the ones seen on CSI, are greatly needed. Have you ever wondered how they are able to extrapolate the time of death when all they have is a body and its temperature? One method of determining the time of death is through a differential equation appearing in Newton's law of heating and cooling. Through basic anatomy and physiology we know that the average temperature of the human body is 98.6° F. After solving the differential equation, calculating the time the body was at 98.6° is relatively simple. A problem encountered in this equation is that it does not account for the temperature change in the event the body had been moved. To fix this problem, a step function, *U*, was inserted to tell the temperature of the medium at any given time. This function then is solved through Laplace transforms and allows us to determine the time of death, even if the body has been moved. One final question we had is just how accurate is this method? Since we did not have a body to experiment with, we experimented with the heating and cooling of distilled water to see if the results given to us by solving the equation matched the results recorded during our experiments.

RICHARD H. SQUIRE, Dept. of Chemistry, West Virginia University - Institute of Technology, Montgomery, WV 25303, USA and NORMAN H. MARCH, Dept. of Physics, Oxford University, Oxford, England. **Can there ever be room temperature superconductors?**

Superconductivity was discovered in 1911 by Kamerlingh Onnes when he reduced the temperature of mercury to 4 K. Forty-six years later Bardeen, Cooper, and Schrieffer published a theory to explain this phenomenon, which we discuss. There has been much speculation about a room temperature superconductor (RTSC). No one doubts the opportunities it offers. We discuss the basic theory of "high-temperature" superconductors that some researchers propose as candidates for a RTSC. Our theory offers an explanation as to why these novel materials become superconductors and suggests new or significantly modified materials need to be discovered if RTSC is to be achieved.

XIAOPING SUN, DAVID HAAS, and KAYANNA SAYRE, Dept. of Natural Sciences and Mathematics, University of Charleston, Charleston, WV 25304. **Synthesis of aryl organosulfur and organoselenium compounds by $AlCl_3$-catalyzed electrophilic aromatic substitution reactions.**

Diaryl sulfoxides (Ar_2SO) and sulfides (Ar_2S), parented by Ph_2SO and Ph_2S, are valuable chemical reagents and have found substantial utility in biomedical and synthetic applications. The currently available synthetic methods for Ar_2SO and Ar_2S are in general complicated and not readily achieved. Very recently, a simple synthesis of these and some related aryl organosulfur and organoselenium compounds has been developed by using novel $AlCl_3$-catalyzed electrophilic aromatic substitution (EAS) reactions. The $AlCl_3$-catalyzed EAS reaction of benzene (PhH) with $SOCl_2$ (molar ratio of PhH : $SOCl_2$: $AlCl_3$ = 2:1:1) was studied. Adding granular $AlCl_3$ piecewise to a mixture of PhH and $SOCl_2$ at about 70 °C, afforded highly pure (99.9%) Ph_2SO as the sole product in a yield of 85%. Adding PhH to a mixture of $SOCl_2$ and $AlCl_3$ at about 0 °C, gave Ph_2S (yield: 37%), Ph_2SO (yield: 27%), and $PhSO_2SPh$ (yield: 5%). At about 25 °C, adding

phenol (PhOH) to a mixture of $SOCl_2$ and $AlCl_3$ ($PhOH:SOCl_2:AlCl_3$ = 2:1:1mole ratio) gave only $(p\text{-}HOPh)_2S$ (yield: 62%) and *p*-HOPhCl yield: 6%). The $AlCl_3$-catalyzed EAS reaction of PhH with $SeOCl_2$ in the molar ratio of $PhH:SeOCl_2:AlCl_3$ = 2:1:1 gave Ph_2Se (yield: 30%) and Ph_2Se_2 (yield: 23%). A possible mechanism has been proposed to account for the formation of all the products, especially for Ph_2S [S(II)] and $(p\text{-}HOPh)_2S$ [S(II)] from $SOCl_2$ [S(IV)], which involve novel reductions of sulfur, and for Ph_2Se [Se(II)] and Ph_2Se_2 [Se(I)] from $SeOCl_2$ [Se(IV)], which involve novel reductions of selenium.

Mathematics/Computer Science/ Engineering

JIANWEI CHENG, Dept. of Mining Engineering, West Virginia University, Morgantown, WV 26506. **Applying data-mining mathematical models into mine ventilation research.**

A ventilation system is an important component of an underground mining system. It should provide a sufficient quantity of air to the underground mine workings, dilute methane and other contaminants, maintain suitable working environment, and prevent accidents from happening. Therefore, a proper early warning model to track and monitor the status of the mine ventilation system should be established. If the ventilation system is running inadequately, an advance-warning message could be issued and operators would then take proper prevention measures to avoid potential risks.

In order to build such an early-warning model, two important technical problems should be addressed. They are how to select the most useful and effective ventilation indexes and how to use these indexes to identify different warning ranks. In this paper, an integrated early-warning model for mine ventilation system has been proposed. Two data-mining techniques are used to assist in building this model. One is Rough Set theory (RS). The RS has a strong reducing ability to eliminate attributes. By using this theory, the most important indexes that can fully characterize the system could be easily identified. The other is Support Vector Machine (SVM). The SVM algorithm has good performances in classification and prediction. Hence, it can be used here in determining the current danger rank for the running system. The application of the developed model to evaluate a coal mine ventilation system has also been demonstrated. The results show that the model has good reliability and could be applied in practice.

JORDAN MUSSER and MARY ANN CLARKE, Dept. of Mathematics, West Virginia University, Morgantown, WV 26506. **Modeling of heat transfer for particles in gas-solid flow utilizing continuum-discrete methodology (CDM).**

The continuum-discrete method (CDM) is a combination of two different modeling techniques for simulating gas-solid flows. Similar to single phase computational fluid dynamics (CFD), CDM describes the gas phase by solving a set of conservation equations over a static grid. For the solid phase, however, each particle is individually tracked and all particle-particle-wall collisions are resolved. This work furthers the development of the continuum discrete methodology by incorporating mathematical models for particle-particle and particle-gas heat transfer. Considerations needed for coupling the gas and solid phase energy equations are presented. Preliminary results demonstrating the implementation of the heat

transfer models into the open-source multiphase flow software MFIX-DEM are discussed.

EGEMEN OGRETIM[1,2], DONALD D. GRAY[1,2], and GRANT S. BROMHAL[1]
[1]Geosciences Division, National Energy Technology Laboratory, Morgantown, WV. [2]Department of Civil and Environmental Engineering, West Virginia University, Morgantown, WV. **On the Accuracy of the Superposition Principle in Monitoring Network Simulations.**

Geologic carbon sequestration is the injection and long-term storage of anthropogenic carbon dioxide in subsurface geologic formations for the purpose of reducing greenhouse gas emissions. Monitoring techniques are required to ensure that the injected CO_2 remains underground. Recent EPA guidelines suggest that near-surface monitoring will often be needed for successful geologic carbon sequestration operations.

Computational simulations are excellent tools for estimating the performance, reliability, and cost of a monitoring network. The level of sophistication of the simulations is often an indicator of the accuracy of the approximation, but is also positively correlated with time-demand and cost of the simulations. In this case, simulations are needed to predict the migration of CO_2 from one or more leaky underground sources through the vadose zone to potential monitoring locations. Because these simulations are computationally intensive, spatial approximations for a single leak have been superposed by several authors and collaborators in reliability calculations. The equations governing the migration of CO_2 in the vadose zone are nonlinear, so the principle of superposition cannot be rigorously valid. In the present study, we are performing preliminary simulations to determine the conditions under which superposition is a satisfactory approximation for simulating CO_2 leaks from multiple leak locations. If this approximation is adequate, the spatial approximations we have developed can be used for the multiple leak situations. If it isn't, then there is no alternative to direct numerical simulations of multiple sources. Our initial findings show that superposition is adequate for certain situations, such as steady state behavior.

This technical effort was performed in support of the National Energy Technology Laboratory's on-going research in carbon capture and sequestration under the RDS contract DE-AC26-04NT41817.

PAUL PECK, Dept. of Science and Mathematics, Glenville State College, Glenville, WV 26351 and JUSTIN NEIL, Braxton County Middle School, Sutton, WV 26601. **Finite Rings with Full Automorphism Group.**

Since a ring automorphism must preserve addition and multiplication, all ring automorphisms must necessarily be automorphisms of R^+R^+, the additive group of the ring. Thus, the following natural problem occurs: Determine all finite rings R whose group of ring automorphisms is the same as the group of automorphisms for R^+R^+. Using selected automorphisms and their effect on products of generators, we answer this problem in the following theorem: R is a finite ring with full automorphism group if and only if one of the following holds:

(1) R is a null ring with $|R| \geq 1$;
(2) $R \cong \mathbb{Z}_2$, the ring of integers modulo 2;
(3) $(R,+) \cong C_{2^m}$ with $m > 1$ and $x^2 = 2^{m-1}x$ where x is a generator for R;
(4) $(R,+) \cong C_{2^m} \oplus C_{2^n}$ with $n < m$ and ${x_1}^2 = 2^{m-1}x_1$, $x_1x_2 = x_2x_1 = 2^{m-1}x_1$, ${x_2}^2 = 0$ where $|x_1| = 2^m$ and $|x_2| = 2^n$; (the x_i are generators for the ring.)
(5) $(R,+) \cong C_{2^m} \oplus C_{2^n}$ with $n < m$ and ${x_1}^2 = 0$, $x_1x_2 = x_2x_1 = 2^{m-1}x_1$, ${x_2}^2 = 0$ where $|x_1| = 2^m$ and $|x_2| = 2^n$;
(6) $(R,+) \cong C_{2^m} \oplus C_{2^m}$ and ${x_1}^2 = 2^{m-1}x_1$, $x_1x_2 = x_2x_1 = 2^{m-1}x_1 + 2^{m-1}x_2$, and ${x_2}^2 = 2^{m-1}x_2$ where $|x_1| = |x_2| = 2^m$;
(7) $R \cong S \oplus T$ where S is as in (3), (4), (5), or (6) above, T is a null ring with $|T| = 2^k, k > 1$, and the characteristic of T is less than 2^n if S is as in (4) or (5) and less than 2^m if S is as in (3) or (6);
(8) $R \cong S \oplus N$ where S is as in (2), (3), (4), (5), (6), or (7), and N is a null ring with $|N| > 1$ and $|N|$ odd.

Funding for this research was provided by NASA Grant NNL06AA20G (Glenville State College Stem Initiatives Enhancement Program.)

FRANZ A. PERTL, Dept. of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506, MARY ANN CLARKE, Dept. of Mathematics, West Virginia University, Morgantown, WV 26506, and JAMES E. SMITH, Dept. of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506. **Design of a compact quarter-wave coaxial cavity resonator for plasma ignition applications.**

Atmospheric and higher pressure RF and microwave plasma sources have numerous applications including material processing and spectroscopy. Recently, advantages in using such discharges for combustion ignition have been investigated. A particularly simple and compact microwave discharge-generating device is the quarter-wave coaxial cavity resonator (QWCCR). A new, compact design of such a device will be presented, whereby a tapered and nested concentric cylindrical structure has been implemented. A simple approximate analysis of the quality factor, Q, a measure of the resonant electromagnetic potential step-up capability, will be given and compared to experimentally measured quality factors, showing reasonable agreement.

Earth Sciences

JUSTIN ELLIS, Dept. of Physics, West Virginia University, Morgantown, WV 26506, FREDRICK JENET, University of Texas at Brownsville, Brownsville, TX 78520, and MAURA MCLAUGHLIN, Dept. of Physics, West Virginia University, Morgantown, WV 26506. **Searching for Continuous Gravitational Waves with Pulsar Timing Arrays.**

Gravitational Waves (GWs) are tiny ripples in the fabric of space-time predicted by Einstein's General Theory of Relativity. Pulsar timing arrays (PTAs) are well poised to detect low frequency (10^{-9}–10^{-7} Hz) GWs in the near future. There has been a significant amount of research into the detection of a stochastic background of GWs from supermassive black hole binaries (SMBHBs). Recent work (Sesana et al 2009) has shown that single continuous sources standing out above the background may be detectable by PTAs operating at a sensitivity sufficient to detect the stochastic background. The main source of continuous GWs in the pulsar timing frequency band are extremely massive SMBHBs and/or nearby SMBHBs.

Here we will present progress towards a data analysis pipeline for continuous GW searches in pulsar timing data. We will discuss two methods of detection and characterization: matched filtering and power spectra addition. The efficacy of these different methods will be discussed as well as their practicality. We will show that for a favorable yet feasible array of pulsars with stationary Gaussian noise, it may be possible to detect GWs from massive, slowly evolving SMBHBs. We will also briefly comment on the problem of estimating the parameters of the SMBHB system using Markov chain Monte Carlo methods.

Social Sciences/Science Education

ADAM FISCHER, WESTLEY MULLINS, JOE EVANS, and GARY Z. MORRIS, Dept. of Science and Mathematics, Glenville State College, Glenville, WV 26351. **Zymurgy... not just for drunks: using beer to stimulate interest in the science laboratory.**

Have you ever had your students moan about how much they hate lab? Consider rewarding their hard work with beer. Does this sound impractical? Not if beer-brewing is your lab. Beer-brewing is an activity that can be used to teach important biological, chemical, and biochemical processes taught in undergraduate microbiology, cell physiology, biochemistry, botany, and organic chemistry. Brewing is a fun activity that instructors will find retains the interest of the students, is simple, and can be designed to fit into several weekly lab periods. Brewing beer allows for the application of several chemical and biochemical assays to each step of the process, including: tests for carbohydrates with Benedict's test and phenol-sulfuric acid assays; tests for protein using the biuret test and Bradford assays; and tests for alcohol content using a hydrometer and pocket refractometer. Analysis of "bitter ale" brewed by undergraduates at Glenville State College using these techniques found that protein concentration increased from 0.15 to 0.32 mg/mL from wart to bottle. It was also observed that the carbohydrate concentration decreased from 91.48 to 58.22 mg/mL from wort to bottle. Reducing-sugar content also decreased from wart to bottle, while percent alcohol increased from 2.7 % at the end of the first week of fermentation to 4.0 % at the end of in-bottle aging. The most crucial test, tasting, was saved for after finals week and was a huge success. We are currently comparing our previous results with new batches and using more techniques for comparison.

M. GLOVER, C. NOLAN, and C. Z. PLAUTZ, Dept. of Biology, Shepherd University, Shepherdstown, WV 25443. **Using an operant conditioning schedule to test for long-term memory formation abnormalities in the pond snail, *Lymnaea palustris*.**

The pond snail, *Lymnaea palustris,* has a simple invertebrate system that we have demonstrated can be used in behavioral studies.

We used an operant conditioning schedule to screen for possible long-term memory (LTM) formation abnormalities following exposure to environmental contaminants. To stimulate pneumostome opening, snails were placed in hypoxic water, then subjected to three 45-minute sessions with one hour between the first two sessions and 24 hours between the second and third sessions. For each session, a tactile stimulus was applied for every instance of an attempted pneumostome opening. LTM formation can be assessed by a significant decrease in number of openings from the first session to the third. We are currently testing for abnormalities in LTM formation following acute exposure to glyphosate (Round Up®). The three experimental sessions are administered in water containing 3500 ppb glyphosate, five times the MCL for glyphosate in drinking water. Experiments are also underway to screen for LTM abnormalities following exposure to caffeine.

ELIZABETH HICKOK, ERIC WAUGH, CHRISTY LITTLE, JAMES SPENCER, HANNAH LONG, MISTY BENNETT, RACHEL BURCH, and ALLISON SAMPLES, Dept. of Psychology, West Virginia State University, Institute, WV 25112. **Edward Thorndike's puzzle box Z with cats: An attempted replication.**

Early studies of animal behavior revolved around problem solving. In 1898, Edward Thorndike tested a variety of animals in puzzle boxes. The animals had to perform certain actions to receive the reward of being released from the box. Thorndike theorized the animals learned through trial and error and would gradually perform the desired actions more consistently when they associated the action with the reward. For box Z, the required action for reward was grooming. This was the puzzle box we attempted to replicate using cats as subjects, as Thorndike did.

We built a modernized version of the box, using wood and Plexiglas™. The dimensions were 10 by 15 by 18 inches, with latched openings on the top and side. Eight cats were tested; all were pets of the various researchers. Six were females, two males; their approximate ages ranged from 7 months to 6 years old. Thorndike used 13 cats, approximate ages of 3 to 19 months. Our criterion was that the cat groom itself five times in a fifteen-minute session for three consecutive days to have mastered the concept. No cat was tested for more than five days. Sessions were conducted on campus and in the pets' homes; all were videotaped.

AMBER A. SMITH, Dept. of Sports Management, and ALAN D. SMITH, Dept. of Management and Marketing, Robert Morris University, Pittsburgh, PA 15219-3099. **Perceived value of e-ticketing: an empirical analysis of sports entertainment options.**

The sporting entertainment industry has been able to increase the production and effectiveness of their customer-relation management departments through the advantages of online ticketing services. Through technological sophistication, online ticketing services minimize concerns, such as costs, delivery modes, and safety to both consumers and companies, compared to traditional ticket services.

An empirical study of business professionals in the Pittsburgh, Pennsylvania metropolitan area revealed that age, amount of disposable income, and education were not predictive of the degree of customer satisfaction derived from the use of e-ticketing for sports events, possibly pointing to the roles of technology and convenience transcending these demographic variables. Concern for identity theft was not a major impediment preventing customers from seeking value in participating in e-ticketing

transactions. Evidence supported the fact that the roles of word-of-mouth advertising and consumer trust are still the foundations for expanding the marketplace for online tickets.

JAMES L. SPENCER, Dept. of Psychology, West Virginia State University, Institute, WV 25112. **The West Virginia lobotomy project (1948 – 1955).**

An estimated 800 West Virginians received transorbital lobotomies from 1948 to 1955 at Lakin, Weston, Spencer, and Huntington State Hospitals. Virtually all of the operations were performed by Walter Freeman, the American neurologist who pioneered the original procedure in the United States in the mid 1930's. The West Virginia Lobotomy Project (WVLP) was authorized by the State Board of Control, primarily as a means of reducing overcrowding at state mental facilities while saving money during economically difficult times. The consequences to these patients have received little prior attention. Now, through archival records of the project and newspaper and magazine articles of the era, as well as interviews of staff that witnessed the procedures, a sobering appraisal of the human suffering of the WVLP can be made.

POSTER PRESENTATIONS

Botany/Zoology/Microbiology

NATHALIE C. AALL, JOSH G. ADKINS, and THOMAS K. PAULEY, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. **Influence of abiotic and biotic factors on movement and microhabitat selection in *Terrapene c. carolina* (Eastern box turtle).**

Natural history studies lay the groundwork for future ecological and behavioral research as well as contribute necessary information toward the management and conservation of species populations. *Terrapene c. carolina* (Eastern box turtle) populations are declining in northeastern deciduous forests. Due to their terrestrial nature, *T. c. carolina* are directly influenced by various environmental conditions, both daily and seasonally, as they navigate through microhabitats. This study investigates the effects of both environmental parameters and individual variation on movement and microhabitat selection of *T. c. carolina.* Beech Fork State Park in Wayne County, West Virginia served as the study site because of a high population density within a relatively small area. Using radio telemetry to assess individual movements, ten *T. c. carolina*, four females and six males, were tagged in May 2010 and followed through October 2010. Individual positions were recorded with a GPS unit at 48- hour intervals for six months. Environmental parameters recorded were relative humidity, barometric pressure, ground temperature, and soil temperature. Also recorded were canopy cover, shade, substrate, and elevation for individual turtles. The results of this study yielded additional data on individual box turtle movements across three seasons and will provide insight on how various abiotic and biotic factors influence behavior.

EARL AMBROZAK and TONY MORRIS, Dept. of Science and Technology, Fairmont State University, Fairmont, WV 26554. **Teratogenic effects of common beverages on *Drosophila melanogaster.***

Since *Drosophila melanogaster* is easy to grow and its life cycle is about 2 weeks, the species is commonly used for studies associated with growth and development. Because many human beverages have toxic

components, we examined the effects of coffee, diet soda, and tea along with a control (distilled water) on fly reproduction. Equal amounts of each liquid were incorporated into the fly media. Trials were performed in triplicate for one generation time. After 2 weeks, the reproduction rates were examined and used as an indication of teratogenic effects relative to controls. Results indicate that the diet soda had the most negative impact while the tea produced rates in favor of reproduction. This may suggest consumption of some beverages should be a consideration for human health.

HASSAN AMJAD, M.D., FLS, Jafary Medical Clinics, 166 George Street, Beckley, West Virginia 25801, and QUARTEL-AYNE AMJAD, M.D., MPH, Beckley, West Virginia 25801. **A new variant American damselfly (*Hetaerina americana*) on the Greenbrier River.**

The American rubyspot is one of the most beautiful insects known. Among the variant subspecies, extreme red is known but at certain locations on the Greenbrier River, a new variant, black striped, has been photographed.

Rubyspot (RS) is a large, broad-wing damselfly about 6.5cm in length. It perches along the edge of fast streams and appears in August–September. Wing-spot size correlates with muscular-fat reserves, which fuel flight during territorial intrusions. The damselfly has an interesting plant-insect interaction. It is a territorial species with the riverine plant, *Justicia americana*, as its habitat. *J. americana* is an aquatic flowering plant with sturdy roots and soft stems that are partially submerged in water. Damselflies appear in late summer in stormy weather with the plant as a secure habitat; the soft stems of the plant are an advantage for piercing and laying eggs by the damsel fly.

While studying RS among *J. Americana*, a new variant was noted. It has three broad circular bands, dark stripes at the thorax, and prominent, darkly colored wings. It appears the development of black bands may give biological advantage for extremely competitive mating tactics.

The specimen was photographed but not caught. A literature search shows it is a new variant, a possible mutation, or a new species.

CHENBO DONG and CERASELA ZOICA DINU, Dept. of Chemical Engineering, West Virginia University, Morgantown, WV 26506. **Elastic mapping of epithelial cells using atomic force microscopy.**

Topological analysis of cells and subcellular structures is one of the major trends in biology. Since the spatial and temporal changes of the mechanical properties of living cells reflect complex underlying physiological processes, there have been considerable efforts in following these changes and providing valuable insight into the biological importance of cellular mechanics and its regulation.

We used atomic force microscopy (AFM) for probing cellular topography and studying mechanical properties of immobilized cells with high spatial resolution and increased sensitivity. Our aim is to produce robust, internally quantitative maps of relative elasticity of fixed cells and compare those maps to those of live cells. Our experimental results demonstrate that spherical mapping of cells can be correlated to cell dynamics and thus provide the possibility to develop additional topologically based approaches to probe the structure-function relationship in live cells.

MEGHAN FRANCIS and ROBERT KREISBERG, Dept. of Natural Sciences and Mathematics, West Liberty University, West

Liberty, WV 26074, and ANNIE MOSEMAN and ALEXANDER POLTORAK, Dept. of Microbiology, Tufts University, Boston, MA 02111. **Genetic analysis of the CpG hypo-response in MOLF/Ei mice.**

Innate immune responses can be activated by Toll-like Receptors (TLRs). TLRs identify specific pathogen-associated molecular patterns (PAMPs). TLR9 recognizes unmethylated CpG DNA called CpG motifs. Since CpG motifs may affect cytokine production, CpG oligodeoxynucleotides may be used as vaccine adjuvants to mount a primary immune system response. TLR9 detects immunostimulatory DNA, such as CpG DNA found in bacteria. In this study, we use a forward genetics approach to study the CpG response in a classical inbred mouse strain, B6, compared to the wild-derived MOLF inbred mouse strain. We specifically investigated the signaling pathway of TLR9 and examined the kinetics of NF-κB and MAPK activation responses to CpG stimulation in peritoneal macrophages and in bone-marrow-derived macrophages (BMDMs). Interestingly, while peritoneal macrophages from MOLF mice are hypo-responsive, bone-marrow-derived macrophages are fully responsive to CpG activation. MOLF has shown restoration in cytokine production in BMDMs and depicts similar qualities to B6 BMDMs. In order to fully understand the phenotype, Western blotting was used for further analysis of the signaling pathways of CpG. Further genetic analyses and genome-wide mapping have revealed a novel role for the function of the macrophage mannose receptor (Mrc1) in CpG stimulation in MOLF wild-derived mice. While the cognate receptor for CpG is well known, the receptors involved in uptake and intracellular trafficking are unknown and remain to be elucidated.

KYLE McGILL, MATHEW Mc KINNEY, KEN CUSHMAN, and ZACHARY LOUGHMAN, Dept. of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Molecular systematics of *Cambarus carinirostris* and *Cambarus b. bartonii*.**

Cambarid crayfishes have received considerable taxonomic attention in recent years. Several species from many genera have been described, and with the advent of phylogenetic methodologies, many pressing taxonomic questions can and have been answered. The taxonomic standing of *Cambarus carinirostris* and its relationship to *Cambarus b. bartonii* represents one such problem. *Cambarus carinirostris* was described by Hay in 1914 and was split from *Cambarus b. bartonii* based on chelae and rostral characteristics. Several authors have not recognized *C. carinirostris*, stating that this taxon is a geographic cline of *C. b. bartonii*. Previous investigators used morphology to determine the taxonomic standing of *C. carinirostris*. We investigated divergence between *C. carinirostris* and *C. b. bartonii* using PCR and the CO I gene and excluded morphology from our analysis. Sequenced results were analyzed with MEGA 4.1 beta 3, and phylogenetic trees containing bootstrap and p-distance values were created from sequence data. Cytochrome oxidase I divergence values between *C. carinirostris* and *C. b. bartonii* samples were not greater than five percent, lending strength to the argument *C. carinirostris* should be synonymized with *C. b. bartonii*. Taxonomic and zoogeographic impacts of this result are discussed.

HANNAH MICK and MARCIA HARRISON, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. **Identification and characterization of novel genes affecting gravitropism.**

When a plant is turned on its side, its shoot system grows upward and its root system grows

downward in a process called gravitropism. As plant stems curve in response to a change in their orientation to gravity, changes in growth patterns regulate how the stem curves upward. In preliminary studies, bundle sheath defective protein 2 (BSD2) has been identified to be potentially involved in this response. Homozygous knock-out mutant (a genetically modified plant in which the gene of interest is disrupted) *bsd2* initiates gravitropic curvature much more slowly than the wild type. Little is known about *bsd2* except that it is located in chloroplasts of the bundle sheath cells (the location where gravity changes are thought to be perceived) and that it has a Dna-J-like region in its protein. Dna-J is a highly conserved protein domain characterized as a heat-shock protein that may be induced as a stress response. Because gravitropism may be characterized as a mechanical stress response, it is hypothesized that *bsd2* is involved in gravitropic curvature. The kinetics of gravitropic curvature of the *bsd2* knock-out mutants will be characterized in the seedling stem (hypocotyl) of *Arabidopsis thaliana.* This research can potentially identify a new protein involved in the signaling events that regulate the complex process of gravitropic curvature.

JAMIE SPONAUGLE, BEN MICK, and GARY MORRIS, Dept. of Science and Mathematics, Glenville State College, Glenville, WV 26351, and ROGER SEEBER and KEN CUSHMAN, Dept. of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Genetic analysis of tomato varieties from Appalachian Sources.**

Roger Seeber has been accumulating native Appalachian tomato varieties to preserve their genomes for over a decade. This process is work-intensive, as the seeds need to be planted every five years to keep the genome viable. Genetic analysis of these genomes would allow the information to be stored digitally. To distinguish between the types of these tomato plants, they are to be examined at the molecular level by analyzing the sequences in their DNA. The molecular methods for distinguishing the differences in the strains have yet to be established. Microsatellites, which are fragments of DNA that have repeating sequences, are also helpful in identifying variations among tomatoes. Having genes of interest in mind is also key to this process. Looking at gene sequences for texture, pulp thickness, carotenoids, richness of the juice, color, blight resistance, and the ability to survive in conditions of harsh temperatures, such as droughts, can also assist in distinguishing between different varieties. Methods to be used to determine the differences between the tomato varieties and to identify the different tomatoes include DNA extraction and polymerase chain reaction. The seeds need to be prepared for DNA extraction by removing the protective sacs that surround the seeds. Various methods can be used to extract the DNA from the seeds to be analyzed. We expect to determine the best approach to analyze the genome of these tomatoes and eventually store digital copies of the DNA so that comparisons can be made from the molecular level.

Ecology/Environmental Science

MARILYNN BURKOWSKI and RICO GAZAL, Dept. of Land Resources, Glenville State College, Glenville, WV 26351. **Exotic plant invasion in West Virginia.**

Continuous encroachment of non-native invasive plants and concomitant site condition modification pose great threats to native plants in West Virginia. In 2007-2008, the

Northern Research Station's Forest Inventory Analysis Program (NRS-FIA) surveyed the presence of 22 invasive plants in West Virginia. Approximately 20% of permanently forested plots in 46 of the 55 counties in West Virginia were surveyed. The non-native plants were chosen based on extent, invasiveness, and level of landowner interest. Using the NRS-FIA data, we generated maps and performed geospatial analysis with a geographic information system (ArcInfo v.10). Tree-of-heaven (*Ailanthus altissima)* was found in 30% of WV counties, whereas Japanese stilt grass (*Microstegium vimineum*) and multiflora rose (*Rosa multiflora*) occurred in 51% and 77% of WV counties, respectively. Japanese stilt grass is the most problematic due to seed longevity, ease of dispersal, and ability to form monocultures under closed canopies. Japanese honeysuckle (*Lonicera japonica*) and Japanese stilt grass covered as much as 40-47% of the sample plots. Hardy County served as a host to 51% of invasive plants surveyed, Lewis County held 45%, and Ritchie and Hampshire Counties contained 41%. Understanding invasive species and the environments where they exist is necessary to determine their impact and to control their spread in West Virginia. Increased forest disturbances (e.g. urbanization, roads, fire) accompanied by increased availability of sunlight, soil moisture, and nutrients could lead to more non-native plants invading, interacting with native species, and posing an even greater negative impact.

R. CIANCAGLINI, C. NOLAN, and C. Z. PLAUTZ, Dept. of Biology, Shepherd University, Shepherdstown, WV 25443.
Disturbances in reproduction and viability in aquatic invertebrates chronically exposed to the herbicide RoundUp® and possible misexpression of enzymes in the steroidogenic pathway.

A wide range of contaminants in the freshwater aquatic environment can perturb the development, viability, and fecundity of aquatic organisms. One common contaminant in runoff is the herbicide RoundUp®. This project aims to elucidate the potential action of RoundUp® on reproductive processes through the use of *Lymnaea palustris* (a freshwater snail) as a model system. *Lymnaea* and humans share highly conserved steroidogenic pathways, and it has been demonstrated *in vivo* that RoundUp® can disrupt mammalian StAR protein, which is critical in the conversion of cholesterol to steroid hormones. Whether similar effects could be observed in snails was tested by raising animals in different concentrations of RoundUp® (1x representing the EPA maximum allowed concentration [MCL], with 5x and 10x run in parallel), quantifying the number of eggs laid, and observing abnormalities in those eggs. Treatment with RoundUp® showed significant effects in upregulating both reproductive rates and embryonic defects in the 1x and 5x groups while producing a higher mortality effect in the 10x group. Preliminary examination of total snail protein via Western Blot revealed cross-reactivity with StAR and cytochrome p450scc antibodies Thus, this procedure may be used to examine further the effect of RoundUp® on the steroidogenic pathway that is shared by *Lymnaea* and humans.

DAVID FOLTZ II*, NICOLE GARRISON*, TRICIA KANGISSER*, NATE TAYLOR*, STUART WELSH**, and ZACHARY LOUGHMAN*

*Dept. of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University, Morgantown WV 26506-6125.
Baited lines, a novel approach to collecting burrowing crayfishes.

Collection methods for organisms are constantly being improved upon to reach the highest capture rate with the least amount of effort. Excavation is the primary method used for collecting primary burrowing crayfish. This method is physically demanding, time-consuming, and difficult in certain habitats. Recently, burrowing crayfish nets (BCN) have been used to collect crayfishes without excavating burrows. Unfortunately, success rates with a BCN are directly correlated to weather events, making the success of this method unreliable. Baited lines are fishing hooks baited with earthworms, tied to 20-30 cm long monofilament leaders, and require investigators to engage crayfishes resting at the entrances of burrows. Crayfish when observed, are tempted with the worms from their portals, and then grasped. The focus of this study was to compare the baited-line method with burrowing crayfish nets and with excavation in a variety of habitats with different crayfish species to determine the success of the baited-line method. Four study areas were selected throughout West Virginia to ensure broad coverage of primary burrowing crayfishes. We used model selection criteria to elucidate the best-fit model associated with our data. The additive model (taxon + sampling method) was the best approximating model to the data (AIC weight = 0.71) and provided evidence for differences in capture rates among taxa and sampling methods. In all instances, baited lines were the most successful method used to collect burrowing crayfishes.

KATHERINE HOECK and MATTHEW BEHRMANN, Dept. of Computer Sciences, Mathematics and Engineering, TREY KNEPPER, Dept. of Environmental Studies, and BENJAMIN REICHARD, Dept. of Computer Sciences, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **Harvest strategies using modifications of the logistic equation.**

This project examines the change in salmon population during harvesting to determine the best strategy for maximizing long-term harvesting. In order to understand what happens to the population during harvest, we first determine what happens without intervention. Without harvesting, the salmon population, p, grows based on the rate of growth r, approaching the carrying capacity k. The maximum slope occurs when $p = 0.5k$. Two methods are modeled to regulate the harvest. (1) The harvest h is held constant and (2) h is a fraction of the population during each time period. In both methods we study the stability of the equilibrium to optimize long-term harvest and avoid extinction. The disadvantage of the methods is that the harvest may change in different time periods, making it more difficult for businesses to appropriately allocate resources. The advantage is that it allows for optimum harvest. The advantage depends on the parameters r, k, h and the length of each time periods.

TRICIA KANGISSER, DAVID FOLTZ II, NATE TAYLOR, and ZACHARY LOUGHMAN, Dept. of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Creation of reach-scale habitat models to determine crayfish abundance in central Appalachia.**

Determining reach-scale variables that could be used to predict crayfish richness and species presence could be a powerful conservation tool for these imperiled animals. This study utilized reach-scale data and QHEI scores to produce predictive models for broad- and species- level associations of different crayfish

species within reach-scale habitats and water quality variables. Crayfish assemblage was measured by abundance (catch per unit effort) at 64 different sites. This study was performed in the Coal and Upper Kanawha River basins of West Virginia. These basins contain large areas heavily impacted by anthropogenic use, specifically mining. The ability of variables to predict crayfish assemblage was assessed using multiple linear regression analysis and R^2 values. Results indicated that several habitat quality characteristics and QHEI individual parameter scores for in-stream cover and pool/current appeared to be important predictors. Interspecies predictive models differed among taxa, indicating different habitat needs for different species. Results from this study indicate physical stream degradation and channelization and the destruction of in-stream cover are the most important threats to crayfishes in central Appalachia. Physiochemical impacts did not readily correlate to crayfish abundance, and did not have much predictive ability. In order to preserve crayfish diversity in central Appalachia, concerted effort should focus on maintaining and creating diverse in-stream habitats, and controlling activities that result in in-stream habitat homogenization.

JOHN LANDOLT, Dept. of Biology, Shepherd University, Shepherdstown, WV 25443, JAMES CAVENDER, Dept. of Environmental and Plant Biology, Ohio University, Athens, OH 45701, ADAM ROLLINS, Dept. of Biology, Lincoln Memorial University, Harrogate, TN 37752, GEORGE NDIRITU, National Museums of Kenya, Nairobi, Kenya, and STEVE STEPHENSON, Dept. of Biological Sciences, University of Arkansas, Fayetteville, AR 72701. **Dictyostelid cellular slime molds of Kenya.**

Dictyostelid cellular slime molds (dictyostelids) are an understudied group in Africa, but samples collected during the period of 2005-2011 have yielded at least nine described species and a number of other forms that appear to be species new to science. In January 2011, small sets of samples were collected from two study sites in the extensive grasslands of the Maasai Mara and a single study site on each of two mountains (Aberdare and Mt. Kenya). These samples were processed using the standard "Cavender" method to isolate dictyostelids. The grassland samples (a total of 10) were almost completely devoid of dictyostelids, and only a single clone was recovered. As such, dictyostelids appear to be much less common in the grasslands of Kenya than is the case for grasslands in the central and western United States. The samples from montane forests on Aberdare and Mt. Kenya were relatively more productive (8 of 13 positive samples), but only a few species were present. All of the species recorded in this most recent survey were members of the genus *Dictyostelium*. This work was supported by a grant from the National Science Foundation.

ZACHARY J. LOUGHMAN, Dept. of Biology, Indiana State University, Terre Haute, IN 47801; Dept. of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Ecology of *Cambarus* (*J.*) *dubius* in north-central West Virginia.**

High-elevation burrowing crayfishes have not received focused research attention, leaving much of their life and natural history unknown. Efficient conservation of these animals cannot occur if basic natural history parameters are not examined. In an effort to gather this data, an ecological study of *Cambarus* (*J.*) *dubius* was performed at Terra Alta, Preston County, West Virginia. Study parameters focused on life history, habitat use, and interspecific interactions with neighboring taxa. Life history information included identifying size

at sexual maturity, age cohort designation, and determining individual age. Habitat utilization was determined by estimating burrow portal/ m^2 for forested seeps and anthropogenic habitats utilized by *C.* (*J.*) *dubius*. Interspecific interactions were documented for all taxa observed utilizing *C.* (*J.*) *dubius* burrows. Morphometric analysis for 263 crayfish determined no significant difference in size at maturity for males and females and at an average age of 18 months. The oldest individuals within the population were 84 months (7 years) old. Burrow-portal densities were highest in forested seep habitats and distributed across the forest in discrete populations, whereas anthropogenic habitat burrow-portal densities were unevenly distributed throughout the landscape and were less dense than forested environs. Interspecific utilization of burrows indicated *C.* (*J.*) *dubius* burrows represent important habitats for plethodontid salamanders and several terrestrial invertebrate species.

ANDREW W. SMITH, CALLIE M. BEAVER, and SARAH M. UMPHRESS, Dept. of Biology, West Virginia University Institute of Technology, Montgomery, WV 25136. **Reproductive strategies of a freshwater annelid, *Lumbriculus variegatus*.**

Lumbriculus variegatus, the California blackworm, is thought to be a true hermaphrodite that primarily reproduces asexually via self-fragmentation followed by regeneration of missing segments. Only one researcher, Charles Drewes, was able to document an instance of sexual reproduction in *L. variegatus*, which was living in a stream. Without further documentation of sexual reproduction, it is commonly thought that they only reproduce via fragmentation even in their natural habitat. In part, this is because it is thought that *L. variegatus* must grow into an adult of a specific length before it would be capable of sexual reproduction. Under normal laboratory culturing conditions, they do not grow to those lengths. The purpose of this research study was to attempt to mimic their natural habit under precisely controlled laboratory conditions in order to document sexual reproduction in *L. variegatus*. This study presents documentation that these hermaphroditic worms reproduce sexually through direct embryonic development within an egg housed in a cocoon. Further, this study documents egg development within the body of the *L. variegatus* prior to the development of the cocoon. It was found that the sexually reproducing *L. variegatus* were no longer in length than asexually reproducing *L. variegatus* but they were slightly larger in body diameter. Thus it may be that it is body diameter rather than body length that determines the 'adult' status. Images and videos of eggs within adult *L. variegatus* will be presented along with images and a video of egg cocoons and juvenile *L. variegatus* in comparison to full-length adults.

ANDREW W. SMITH, SHAWN M. HUTCHINSON, and SARAH M. UMPHRESS, Dept. of Biology, West Virginia University Institute of Technology, Montgomery, WV 25136. **Attenuated regeneration in *Lumbriculus variegatus* exposed to selenium.**

Lumbriculus variegatus, a freshwater oligochaete, lives in shallow habitats at the edges of ponds, lakes, and marshes where it feeds on decaying vegetation and microorganisms. These habitats are being contaminated with toxic heavy metals, such as selenium, by human activities including coal mining and coal-burning factories. It has been reported that selenium concentrations in West Virginia rivers downstream of mountaintop mining operations are in excess of current EPA standards. Soluble selenium in the form of SeO_4^{-2}, SeO_3^{-2}, or organic selenium compounds

are an essential nutrient in many organisms. However, selenium in concentrations at approximately 7 to 30 times greater than dietary requirements is toxic and will bioaccumulate in aquatic organisms. In this study, we examined the effects of selenium on regeneration in healthy adult *L. variegatus* in the size range of approximately 3–5 cm. Worms smaller than three cm or larger than five cm were excluded from this study, as were any worms that were in the process of asexual reproduction. To induce regeneration, *L. variegatus* were individually sectioned into three parts: head, mid-body, and tail. Each portion was placed into separate, labeled containers, and selenium dissolved in dechlorinated tap water was added. Segments per body part (head, mid-body, tail) were determined at the start of the experiment and at weekly intervals. Pulse rate and behavior in adult *L. variegatus* exposed to various concentrations of selenium were also determined. Concentrations of selenium tested demonstrated a decrease in total number of regenerated segments per body part, and increasing concentrations of selenium demonstrated decreased regeneration. Further, selenium exposure demonstrated an overall increase in basal pulse rate and altered behavior.

CLIFFORD E. STARLIPER, VICKI BLAZER, LUKE IWANOWICZ, HEATHER ELLERY, and ADAM SPERRY, USGS Leetown Science Center, 11649 Leetown Road, Kearneysville, WV 25430. **Bacterial etiology from recent smallmouth bass (*Micropterus dolomieu*) die-offs from local rivers within the Chesapeake Watershed.**

In recent years, significant diseases and mortality have been noted in the Chesapeake watersheds, including the Potomac River in WV and the Susquehanna River in PA. The die-offs were relatively host-specific with smallmouth bass (SMB) being the primary affected host. Die-offs were recognized (i.e. dead fish floating) in mid-summer at peak high-water temperatures that favor bacterial pathogen growth and contribute to reduced dissolved oxygen concentrations that are detrimental to sustaining fish health. Moribund and dead fish displayed gross external lesions and abnormal internal pathology, which, along with histopathological evidence noted in 2009, indicated bacteria as the cause. From mid-July to early August, 2010, we examined 57 moribund fish from seven sites on the Susquehanna River in Pennsylvania. Most were young-of-year SMB, but we also sampled a few one-year-old SMB from one fish collection site, two largemouth bass and one sucker. In 2011, lesions were again prevalent (54% had lesions) and nearly dead fish displayed internal pathology consistent with bacterial disease signs. Lesions and kidneys were streak-plate-cultured onto bacteriological media and resulting bacteria were characterized with phenotypic and genotypic methods. Heavy-growth bacterial cultures were recovered from fish from all collection sites. The predominant bacteria were *Aeromonas* spp. (recovered from 97% of the lesion cultures), primarily *A. veronii-sobria*, and *Flavobacterium columnare* (90% positive), both of which are recognized pathogens to many fish species. *Plesiomonas shigelloides* was also common from kidneys (10 of 57 samples were positive). Mortality subsided after 2-3 weeks, as is common with a bacterial disease process and as cooler water temperatures prevailed.

CLIFFORD E. STARLIPER and BARNABY J. WATTEN, USGS Leetown Science Center, 11649 Leetown Road, Kearneysville, WV 25430. **Bactericidal treatment of bacteria recovered from ballast tanks from the *Indiana Harbor*, a bulk cargo ship.**

Ship ballast (water) is associated with

consequential movements of non-indigenous aquatic invasive species. In one effort to control the spread of invasive aquatic organisms, legislation developed by the International Maritime Organization, the United Nations Agency responsible for the prevention of pollution by ships, requires ships constructed during and after 2009 to decontaminate ballast on board to conform with "D2 Standards" for maximum allowable numbers of indicator microorganisms. Our center is developing hydroxide stabilization as a method to decontaminate ballast water to meet these D2 Standards. We previously reported that minimum treatment parameters of pH 12.0 for 72 hr duration attained a 100 % bactericidal effect of various bacteria including, Gram-negative and Gram-positive environmental and fish pathogens, coliforms, and the D2 Standards indicator microorganisms. During working voyages in 2009 and 2010 by the *Indiana Harbor*, a 1,000+-foot bulk-cargo ship, on Lake Superior and Lake Michigan, we recovered bacteria from ballast tanks to test the bactericidal effect of our developmental high-pH methodology. We developed pure cultures from these bacteria and grew each at optimal laboratory conditions (controls) and tested pH 10.0, pH 11.0, and pH 12.0 from four through 72 hr. Thus far, 100 cultures (50/year) have been evaluated; minimum bactericidal parameters were pH 11.0 for 72 hr. or pH 12.0 for 24 hr. In addition to bactericidal efficacy, the higher pH of ballast water is anti-corrosive to the steel ballast hulls, and our methodology shows favorable delivery and mixing process economics relative to other developmental methods.

NATE TAYLOR, DAVID FOLTZ II, TRICIA KANGISSER, and ZACHARY LOUGHMAN, Dept. of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Conservation of West Virginia's Kanawha River bottomland burrowing crayfishes: species relationship to soil composition and compaction with an emphasis on *Fallicambarus fodiens*.**

Crayfish conservation efforts have become increasingly more prevalent over the past decade, with the majority of conservation directed toward epigean species. Burrowing crayfishes have not received the same level of intensity of investigation. In West Virginia, the Kanawha River floodplain (KRFP) of Mason and Putnam counties is the center of burrowing crayfish diversity. Burrowing species occurring in bottomland forests in the region include *Cambarus thomai*, *Fallicambarus fodiens*, and *Procambarus acutus*. *Cambarus thomai* is common throughout the KRFP bottomlands. Both *F. fodiens* and *P. acutus* are endangered in West Virginia, with distributions limited to the Kanawha River floodplain. Identifying preferred habitat for these species is the first step towards their conservation. In order to identify specific broad habitat types harboring high levels of burrowing crayfish diversity, soil analysis was conducted at eight sites located within the remaining bottomland forest of the KRFP. Soil compaction levels were determined using a soil compaction meter. Soil type was also determined through percentages of sand, silt, and clay particles found in soil cores extracted from each site. Loam soils had the highest diversity levels and were the only soil type in which both *F. fodiens* and *P. acutus* occurred simultaneously. *Fallicambarus fodiens'* and *P. acutus'* apparent dependence on attributes associated with loam soils warrants possible use of this soil type as a future predictor of potential sites harboring these state-endangered species. *Cambarus thomai* was present at all sites and was not allied to a specific soil type.

RYAN THOMAS, BEN COULTER, and RICO GAZAL, Dept. of Land Resources Glenville State College, Glenville, WV 26351. **Canopy gap characteristics of an oak-dominated forest in Appalachia.**

Canopy gaps or openings directly influence species composition, structure, and regeneration. In this study, we determined the understory communities under various gap sizes (open, medium, and closed canopy) in an oak-dominated forest in Gilmer County, WV. There were three plots (1x1, 5x5 and 10x10 m) established at each gap size and each plot consisted of three subplots where specific vegetation types were surveyed. Mid-tolerant species like red maple (*Acer rubrum*), red oak (*Quercus rubra*), and black cherry (*Prunus serotina*) were found colonizing the large and medium gaps along with tolerant species such as dogwood (*Cornus alternifolia*) and American beech (*Fagus grandifolia*). Closed canopy plots tend to be dominated by both tolerant and mid-tolerant tree species. Greenbrier (*Smilax* spp.), multiflora rose (*Rosa multiflora*), and autumn olive (*Eleagnus umbellata*) dominate all gap sizes indicating the ability of these species to survive under different light conditions. Japanese stilt grass (*Microstegium vimineum*), an invasive species, dominates all gap sizes and is known for its seed vitality, shade tolerance, and fast growth. Although not statistically significant, diversity and evenness of all understory species were found to be higher in large gaps compared to both medium and closed canopy plots. Diversity of shrub species was found higher in closed canopy plots than large gaps. The attributes of canopy gaps such as size, shape, and disturbance origin affect the forest characteristics. The future of our forests largely depends on the survival of the understory tree species that eventually determine the dominant forest cover type.

GARY D. THOMPSON and THOMAS B. FORD, Dept. of Biology, Concord University, Athens, WV 24712. **Assessment of passive treatments of a stream impacted by acid mine drainage.**

Acid mine drainage within WV is a widespread and persistent problem to humans and wildlife. Common practices of remediation in WV utilize passive treatments to mitigate pollution. To assess the effectiveness of these treatments, one AMD stream (Morris Creek) and one non-AMD stream (Davis Creek) were analyzed for various water chemistry parameters, such as presence of heavy metals, conductivity, and pH. Assessments of the macroinvertebrate communities were also performed for both streams. The AMD stream ranged from 243.1–1092.3 µS/cm for conductivity and 3.47–8.28 for pH; the non-AMD stream ranged from 66.9–81.3 µS/cm for conductivity and 7.55–8.13 for pH. The AMD stream contained fewer pollution-sensitive macroinvertebrate taxa compared to the non-AMD stream. These results suggest that AMD within the Morris Creek watershed is not being successfully mitigated by passive treatment. This research was supported by the Concord University Biology Dept. and the McNair Scholar Program.

CHARLES Z. WALBURN and LESLIE C. HOPKINSON, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. **Near-bank turbulence generated by vegetation under storm flows.**

While considerable research has been conducted on the role of vegetation in reducing streambank failure, significantly less is known about vegetation's influence on fluvial erosion and the incipient motion of streambank sediment. The goal of this

research is to quantify the relationship between streambank vegetation and near-bank stream flow. The study will address the following specific objectives: (1) quantify turbulence along vegetated streambanks at base flow and (2) quantify changes in turbulence along a vegetated streambank through a storm hydrograph.

Six experimental cross-sections of varying vegetation roughness types will be identified along Yellow Creek in Davis, WV. Channel geometry, grain roughness, and vegetation parameters (frontal area, flexibility, location, size, and density) will be monitored throughout the study. Velocity will be measured using a velocimeter at base flow (5-min sample time at 50 Hz) near the streambank toe at least six times throughout the study period. Velocity samples will be analyzed by calculating turbulence parameters: Reynolds stresses, turbulent kinetic energy, and turbulence intensity. Significant vegetation parameters that influence turbulence production will be identified. The velocimeter will then be used to measure three-dimensional velocity during three storm flows, showing the distribution of boundary shear stress and turbulence generation throughout storm events. This analysis will provide information about erosion potential throughout storm events. The successful completion of this project will propose a new method to monitor near-bank flows at periods of high flow and will lead to future studies to improve streambank erosion control and recovery.

Biochemistry/Health Sciences

SUKANYA R. BAKSI, TRAVIS L. FERGUSON, CHRISTOPHER B. SMURTHWAITE, CARLY R. SCHUTZ, DIANNE K. ANESTIS, and GARY O. RANKIN, Dept. of Pharmacology, Physiology, & Toxicology, Joan C. Edwards School of Medicine, Marshall University, Huntington, WV 25755. **Mechanistic aspects of 3,5-dicholoraniline nephrotoxicity in vitro.**

Chloroanilines are widely used in manufacturing dyes, drugs, agricultural chemicals, and industrial intermediates. Previously, we demonstrated that 3,5-dichloroaniline (3,5-DCA) induced nephrotoxicity in vivo in rats and in vitro in a rat renal cortical slice model. In this study, freshly isolated renal cortical cells (IRCC) from male Fischer 344 rats were used to investigate the nephrotoxic potential of 3,5-DCA and to examine if metabolites and/or oxidative stress contributed to 3,5-DCA-induced nephrotoxicity in vitro. Nephrotoxicity was determined by incubating IRCC (~4 million cells/mL; 3 mL total volume) with a vehicle (dimethyl sulfoxide, DMSO; 30 µL) or 3,5-DCA (0 – 1.5 mM) for 60, 90, or 120 min and calculating lactate dehydrogenase (LDH) release as a percent of total LDH. In some experiments, IRCC were pretreated with antioxidants (2.0 mM ascorbate, 1.0 mM glutathione, 1.0 mM α-tocopherol, or 2.0 mM N-acetyl-L-cysteine) to explore the role of oxidative stress. In other experiments, IRCC were pretreated with a cyclooxygenase inhibitor (1.0 mM indomethacin), CYP inhibitor (1.0 metyrapone; 1.0 mM piperonyl butoxide), or FMO inhibitor (1.0 mM methimazole; 2.0 mM n-octylamine) to explore the role of metabolites in 3,5-DCA nephrotoxicity. Nephrotoxicity of 3,5-DCA was evident at 120 min at 0.5 mM 3,5-DCA and by 60 min at higher concentrations. All pretreatments reduced 3,5-DCA nephrotoxicity to varying degrees. These results suggest that 3,5-DCA is nephrotoxic to IRCC in a time- and concentration-dependent manner, that metabolites contribute to 3,5-DCA nephrotoxicity, and that oxidative stress may be a mechanism for inducing 3,5-DCA nephrotoxicity.

TRAVIS L. FERGUSON, SUKANYA R. BAKSI, DIANNE K. ANESTIS, and GARY O. RANKIN, Dept. of Pharmacology, Physiology, & Toxicology, Joan C. Edwards School of Medicine, Marshall University, Huntington, WV 25755. **Effects of cytochrome P450 (CYP) and flavin monooxygenase (FMO) inhibitors on 4-amino-2-chlorophenol (4A2CP) nephrotoxicity in vitro.**

Choloranilines are commonly used as chemical intermediates in the manufacturing of agricultural chemicals, dyes, and pharmaceuticals. Many of the chlorinated phenol intermediates have been shown to cause nephrotoxicity in Fischer 344 rats. Previous studies have shown that 1.0 mM 4A2CP induced nephrotoxicity in isolated rat renal cortical cells (IRCC) during incubation for sixty minutes in Krebs-Henseleit buffer. The purpose of this study was to examine the different biological pathways (P450, FMO, and oxidation-reduction) of activation of 4A2CP using a rat renal in vitro model. IRCC were obtained from male Fischer 344 rats and incubated in Krebs-Henseleit buffer. IRCC (4 x 10^6 cells per mL) were added and incubated with dimethyl sulfoxide (DMSO) or with 4A2CP (1.0 mM) in a shaker bath for sixty minutes. In some experiments, IRCC were pretreated with an FMO inhibitor [N-octylamine (0.2 μM) and methimazole (1.0 mM)], cytochrome P450 inhibitor [isoniazid (1.0 mM), ketoconizole (1.0 mM), and metyrapone (1.0 mM)] or an antioxidant [α-tocopherol (1.0 mM and 2.0 mM)]. Cytotoxicity was determined by measuring the release of LDH (lactate dehydrogenase). In the case of FMO and CYP inhibitors, the LDH measurement did not indicate a significant decrease in toxicity. Alpha-tocopherol, in a concentration-dependent manner, showed slight protection from 4A2CP toxicity. These results suggest that the mechanism by which 4A2CP becomes toxic is not activation by FMO's or CYP's. Alpha-tocopherol protection suggests that a toxic metabolite is created via an auto-oxidation process and/or that oxidative stress plays a role in 4A2CP nephrotoxicity.

WHITNEY SHEPPARD, Dept. of Chemistry, and JEFFERY GROFF, Institute of Environmental and Physical Science, Shepherd University, Shepherdstown, WV 25443. **A computational investigation of calcium puffs and sparks at heterogeneous release sites.**

Localized cytosolic calcium (Ca^{2+}) elevations known as puffs and sparks are essential regulators of cellular function that arise from Ca^{2+}-activated inositol 1,4,5-trisphosphate receptors (IP_3Rs) and ryanodine receptors (RyRs) clustered at Ca^{2+}-release sites on the surface of the endoplasmic or sarcoplasmic reticulum. Experimental evidence suggests that Ca^{2+}-release sites are not always homogeneously composed of identical channels. Instead, release sites are often composed of a mixture of isoforms from the IP_3R and/or RyR channel families, and some channels at a release site may have experienced post-translational modifications such as phosphorylation or may have associated with accessory proteins that change the dynamics of their gating. This study uses computational models to study the dynamics of puffs and sparks arising at such heterogeneous Ca^{2+}-release sites. Specifically, release sites involving two types of channels are studied. Both channel types have identical Ca^{2+}-activation kinetics but only one channel type exhibits Ca^{2+}-dependent inactivation. The statistics of simulated puff/spark formation and collapse are studied as the fraction of channels exhibiting Ca^{2+}-dependent inactivation and the strength of Ca^{2+} coupling between channels are varied. Importantly, simulations of heterogeneous release sites often exhibit puffs and sparks that are more robust (as measured by the index of dispersion

of the number of open channels) than puffs/sparks exhibited by homogeneous release sites. In general, the amount of calcium released per puff event (estimated by calculating puff area) increases as the fraction of channels that inactivate decreases. This work was supported by WV HEPC DSR Grant No. HEPC.dsr.10.10.

Mathematics/Computer Science and Engineering

DANIEL BARNHOUSE, OSMAN GUZIDE, and WEIDONG LIAO, Dept. of Computer Sciences, Mathematics, and Engineering, Shepherd University, P.O. Box 5000, Shepherdstown, WV 25443. **Using biometrics to enhance information security.**

Biometric technology is a technology that is in high demand currently. Most technologies in today's society have some sort of biometric security implemented in it. Whether it is fingerprint, facial, iris, or voice recognition, each of these approaches is useful in its own way. In this poster, we will review the security features with these different approaches, their weaknesses, and discuss how to possibly make these technologies more secure than they already are.

JASON HAMILTON, DARIUS REYNOLDS, and MARK JAMES, Dept. of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506. **Electromagnetic enhancement of a fluidized bed in microgravity.**

Fluidized beds are an existing technology used to achieve high levels of contact between a solid particulate and a flowing gas or liquid. This technology has been implemented to increase process efficiency in various applications ranging from filtration to particle coating to combustion. While it has demonstrated benefits in an environment where the gravitational force is influential, very little research has been conducted on fluidized beds in a microgravity environment. This is a critical issue as this technology may have the potential to be utilized in microgravity for the same range of applications as on Earth.

This current research effort aims to enhance the performance of previous work in microgravity that implemented an electromagnetic field to simulate the gravitational force by incorporating a rotating, time-dependent electromagnetic field. Inducing a rotating magnetic configuration is theorized to increase the amount of mixing between the solid particulate and the fluid, be it air or water. Further mixing between the two phases will increase the reaction rates, thereby increasing the efficiency of the fluidized bed when utilized in microgravity applications. Mixing can be enhanced by many variables including, but not limited to, the mass flow rate of the flowing gas or air and the angular rate of the rotating electromagnetic field. It is anticipated that an increase in both variables will result in further surface area interaction.

This work is a culminating effort to create optimized reaction mixture techniques for future space-based microgravity applications in which filtration and/or chemical reactions must be optimized.

WEIDONG LIAO and OSMAN GUZIDE, Dept. of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **Accelerating J-GCD using GPU computing and CUDA.**

The greatest common divisor (GCD) computation is one of the meta-services used by many mathematical computations. If a

separate, dedicated, and efficient service can be provided, various research efforts that require GCD computation can focus energies elsewhere.

In this poster we introduce a feasible approach to utilizing GPU computing and CUDA to accelerate J-GCD package, which implements a variety of GCD algorithms (such as the Euclidean Algorithm and the Binary GCD Algorithm) with and without using a computer algebra system. Experiments have shown that significant performance improvement may be achieved.

CHRISTOPHER C. WALLACE, OSMAN GUZIDE, and WEIDONG LIAO, Dept. of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **Quantum cryptography: a step into security's future.**

There is something special about the word *quantum*. That word conjures up visions of Sci-Fi movies, mad scientists' laboratories, and even black holes. Yet, in this work's context it can mean so much more. Quantum relates to the cutting edge of information security. This poster is intended to introduce the reader to the world of quantum cryptography. To accomplish this it will mean taking a quick look at quantum physics, random number generation, entropy, the components in a quantum system, security risks, and the future of quantum cryptography.

THOMAS WILLOUGHBY, OSMAN GUZIDE, and WEIDONG LIAO, Dept. of Computer Science, Mathematics, and Engineering, Shepherd University, Shepherdstown, WV 25443. **Is cloud computing the future?**

Over the past couple of months, we have seen numerous "the cloud" commercials from Microsoft Corporation regarding its new operating system. In these commercials, Microsoft shows that the cloud can show video from another computer, send videos to other people, and have numerous people work on the same project at the same time, to name the most notable ones. In this poster, we discuss what cloud computing is and why it is being hyped so much by Microsoft, how it works, what problems it could lead to, and how it can be used in our day and age.

Earth Sciences

HASSAN AMJAD, M.D., FLS, Jafary Medical Clinics, 166 George Street, Beckley, WV 25801, ROBERT L. PYLE, Morgantown, WV, and QUARTEL-AYNE AMJAD, M.D., MPH, Beckley, WV 25801. ***Daubreeria pateraeformis*** **(Germar) Zeillar, Upper Pennsylvanian megafossil plant in WV, a newly found locality.**

The rare plant megafossil, *Daubreeria pateraeformis,* was described in 1888, from Germany and France. A nearly perfect, large specimen was excavated at Barrackville, WV by R. P. A complete preserved specimen is very rare at any site.

A brief description: large leaves, with raised midrib, appearance similar to cyloptera. There are four lateral fused segments per leaf. Our specimen has a diameter of 15 cm, quadripartile fused leaves, margins damaged according to Gillespie; this was a floating leaf with no real stem. Habitat occurs in swampy areas. Exact taxon description of this fossil remains speculative and often described vaguely as resembling *Equisetum Linn.*

Daubreeria is similar to the modern day pond lily or the rare *Rafflesia arnoldii*, found

in deep forests in Sumatra. An ecological remnant of ancient swamps *R. arnoldii* is an endoparasitic plant with delicate thin filament roots.

We proposed a hypothesis: *Daubreeria* may have been a floating mass of leaves with a central cylinder for a primitive fruiting body during the late Carboniferous era. Its roots were submerged in highly enriched mineral coastal swamps among ancient pecopteris and mangrove trees. Fine preservation of our specimen was possible because it was embedded in a large rock, which, when split in the middle and opened carefully, produced a nearly perfect specimen.

JASON BEST and DAVID KATZ, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **A preliminary analysis of clustering as a function of color in the DEEP2 Redshift Survey.**

One of the critical methods for understanding galactic evolution is the exploration of the possible correlation between galactic type and environment. Using a fractal-based statistic to quantify galactic environments, we analyzed the Third Data Release of the DEEP2 Redshift Survey, which targeted approximately 50,000 distant galaxies in the redshift range $0 < z < 1.4$. Paralleling previous work, each galaxy was assigned a morphological classification based on observed color. We find that for the majority of our comparisons, the complete environments of early-type galaxies vs. late-type galaxies are not dissimilar to the 99th percent level. This differs from the results of our comparisons of early-type galaxies vs. late-type galaxies in which the environments are constrained by morphology. When the environments are morphologically constrained, numerous comparisons between early-type galaxies and late-type galaxies are dissimilar to the 99th percent level. This difference between the two analyses illustrates both the importance of complete environment comparisons within our evolutionary modeling, as well as the dominance of the interaction of specific morphologies upon the evolution of similar galactic types.

Social Sciences/Science Education

BROOKE ANDREWS, CRAIG ARTHUR, COREY CURRY, and GARY MORRIS, Dept. of Science and Mathematics, Glenville State College, Glenville, WV 26351. **Teaching undergraduates the laboratory procedure of bacterial gene transfer and what it means for protein expression and purification.**

Competent cells, which are specially treated bacteria such as *E. coli* DH5a, can be manipulated to take up DNA and express genes from this DNA, thus converting the bacteria into chemical factories for protein synthesis. This process is known as transformation. DH5a cells can be transformed with a pBR322 plasmid, which encodes the tet^R gene that renders the cells tetracycline-resistant. Here we transform DH5a cells with pBR322 to learn the technique of transformation. Once we are proficient, cells will be transformed to express and purify cyclic adenosine monophosphate-dependent protein kinase (also called PKA). Transformation of DH5a cells with pBR322 was successful, as seen by consistent growth of transformed bacteria on plates that had the tetracycline and no growth on the plates that had tetracycline and bacteria that were not transformed. DNA from transformed bacteria was extracted and purified using one of two commercially available kits (BioRad Plasmid Midiprep Kit or Quiagen Plasmid Maxiprep kit) and analyzed on agarose gel and with spectroscopy. We will also practice

transformation of cells using pFluoroGreen and pFluoroBlue plasmids, which express proteins that fluoresce under a long wave UV light, allowing easy determination of successful transformation of bacteria without the use of antibiotics. Once proficient, we will transform *E. coli* competent cells with an *amp*^{R} PKA-expressing plasmid. PKA is a protein that acts along several signaling pathways of animal cells. After successfully expressing PKA, we will be able to do further biochemical research with it.

JOANNA L. BAIRD and RUTH A. CONLEY Ph. D., Dept. of Biology, Shepherd University, Shepherdstown WV 25443. **Evidence for shy/bold syndrome in an invertebrate, *Gromphadorhina portentosa*, the Madagascar hissing cockroach.**

Behavioral syndromes, such as shy/bold syndrome, have been recorded in a multitude of social animals, from cephalopods to avian species, and have been widely documented. There have been very few observations made to see if shy/bold syndrome occurs in social insects, such as the Madagascar hissing cockroaches. Shy/bold syndrome is commonly seen in social animals due to the interactions in the animals causing some to be shy and some to be bold. We used two tests to determine the presence of shy/bold syndrome – time to right themselves after being flipped onto their backs and time to emerge from a secluded house to investigate enticing food. Social behaviors were recorded for five nights, and individual submissive and dominant behaviors were tallied and used to outline a dominance hierarchy for each of three colonies. Dominant behaviors included tail wagging, hissing, head-butting, and prime territory location, whereas submissive behaviors included body-curling and satellite territory. The results show that the more dominant roaches quickly righted themselves; conversely, the more submissive individuals emerged more quickly from the houses to investigate the food source. This suggests that the dominant males claim the prime territory of the secluded house, while submissive individuals explore rather than claim territory. This implies that risk-taking behaviors (boldness) can be exhibited by submissive individuals. The time to right oneself following a flip may be related to that dominant individual's readiness to claim and defend a territory. The study was funded in part by a NASA grant to J. Baird.

ADAM FISCHER, WESTLEY MULLINS, JOE EVANS, and GARY Z. MORRIS, Dept. of Science and Mathematics, Glenville State College, Glenville WV 26351. **Zymurgy... not just for drunks: using beer to stimulate interest in the science laboratory.**

Have you ever had your students moan about how much they hate lab? How about rewarding their hard work with beer? Sound impractical? Not if beer-brewing is your lab. Beer-brewing is an activity that can be used to teach important biological, chemical, and biochemical processes taught in undergraduate microbiology, cell physiology, biochemistry, botany, and organic chemistry. Brewing is a fun activity that instructors will find retains the interest of the students, is simple, and can be designed to fit into several weekly lab periods. Brewing beer allows for the application of several chemical and biochemical assays to each step of the process, including tests for carbohydrates with Benedict's test and phenol-sulfuric acid assays; tests for protein using the biuret test and Bradford assays; and tests for alcohol content using a hydrometer and pocket refractometer. Analysis of "bitter ale" brewed by undergraduates at Glenville State College using these techniques found that protein concentration increased from 0.15 to

0.32 mg/mL from wort to bottle. It was also observed that the carbohydrate concentration decreased from 91.48 to 58.22 mg/mL from wort to bottle. Reducing-sugar content also decreased from wort to bottle, whereas alcohol increased from 2.7% at the end of the first week of fermentation to 4.0% at the end of in-bottle aging. The most crucial test, tasting, was saved for after finals week and was a huge success. We are currently comparing our previous results with new batches and using more techniques for comparison.

INSTRUCTIONS TO AUTHORS

(http://www.marshall.edu/wvas/AUTHORS.HTML)

1. General Policy

The publications policy of the Academy is intended to implement the goal of publication of the *Proceedings* by the Academy, namely, stimulation of research on the part of West Virginia scientists and Academy members by providing an outlet for publication of their research results. Within the limits of available resources, the Academy will attempt to maximize the number of articles it can publish, while maintaining standards by the peer review process. Where selection must be made, the sole criterion for judgment shall be the quality of the research involved. Articles of a local or regional nature, as well as those of broader scope, are encouraged. Articles will not be discriminated against because of their subject matter, as long as they satisfy the requirement of the bylaws (http://www.marshall.edu/wvas/WELCOME.HTML; click on the Bylaws link) that they be "...of a scientific nature" (Section VII, Article 1).

The Academy will consider papers that report the results of original research or observation. The Academy will not publish papers that have been published elsewhere. Each manuscript will be reviewed by the Publications Committee and by referees. Manuscripts longer than 15 pages of double-spaced, typed copy normally will not be accepted. Membership in the Academy is a requirement for publishing in the Proceedings. In the case of joint authorship, at least one author must be a member of the Academy. No author, or co-author, may submit more than two papers for any volume of the Proceedings. Ordinarily, papers offered for publication must have been presented at the annual meeting of the Academy but presentation is not a requirement for publication. Publication is not automatic. The *Proceedings* editors also solicit outstanding expository papers.

2. Abstract for Annual Meeting

A 'call-for-abstracts' announcement is mailed to each member in the fall.

The abstract will be formatted in the following manner:

JOHN SMITH, Dept of Biological Mathematics, West Virginia University, Morgantown, WV, 26506, and JIM DOE, Dept of Chemical Sociology, Marshall University, Huntington, WV 25755.
Analysis of trigonometric cell structure in the chromosome.

Skip one line and begin the first paragraph of text. Single-space the text. Start each new paragraph by indenting 0.25" (1/4") using a tab, not the space bar. Do not skip a line between paragraphs. Standard abbreviations may be used. The abstract should contain a brief statement of (a) the objectives of the study, (b) the method of study used, (c) the essential results including data and statistics, (d) the conclusions, and (e) the source of support (if applicable). Figures and tables cannot be accommodated. Please check the abstract for misspellings, poor hyphenation, and poor grammar. The text of the abstract should not exceed 250 words.

3. Manuscripts

Manuscripts for publication should be sent to the editor, Dr. G. Paul Richter, 112 Fayette Street, Buckhannon, WV 26201. Manuscripts must be sent electronically (email or compact disk) in Microsoft WORD to richter_p@wvwc.edu. One hardcopy should also be sent to the address above. Proofs, edited manuscripts, and all correspondence regarding papers for publication should be directed to the editor. For additional information, call (304) 472-3317.

a. Cover-sheet (Title and by-line)

The cover sheet for each manuscript should include the title (bold, 12-pt. New Times Roman font) of the paper followed by the names and business addresses of all authors. The corresponding author should be indicated by an asterisk and include a business phone number, fax number (if available), and e-mail address (if available)

b. Organization of Manuscripts

Each manuscript shall start with an abstract (no more than 250 words) that should summarize the primary results. In general, the introductory abstract will replace a summary. This abstract should be suitable for sending to international abstracting services for immediate publication in the event that the paper is accepted for publication in the *Proceedings*.

The following sequence is suggested for organizing a paper: Introduction, Materials and Methods, Results, Discussion, Acknowledgments, and Literature Cited.

The text should be double-spaced (New Times Roman 12 pt. font size), and pages should be numbered consecutively in the top right-hand corner of each page preceded by the author's last name.

Major section headings (**INTRODUCTION**, **METHODS**, etc.) are to be bold and all caps and subsection headings should presented in 10-pt font size, in all caps but not bolded.

Using a tab, not the space bar, indent each paragraph 0.25" (1/4").

c. Grammatical Considerations

Place two spaces between the period at the end of one sentence and the first letter of the next sentence.

Hyphenate compound modifiers and compound words. A modifier made up of an adverb (other than adverbs ending in *-ly*) + adjective, adjective + noun, or two nouns is a compound or unit modifier. E.g., *plum-pox-resistant, transgenic plum*, where *plum-pox-resistant* is the compound modifier (hyphens are boldface for emphasis). Note: chemical names used as modifiers are not hyphenated except when misinterpretation is likely. Examples: 1. Iron sulfide containing bacteria is commonly found ... ; 2. Iron sulfide-containing bacteria are … (In example 1., a sample of iron sulfide that contains bacteria within it is the subject; in example 2., the bacteria contain iron sulfide and *bacteria* is the subject.

Include a comma after each member in a series of words that form a list in a sentence, form a series of modifiers modifying the same item, or for a series of phrases, as this sentence itself exemplifies. E.g., *...dogs, horses, antelope, and trout...* A different example exemplifies an important exception: When an adjective or noun acting as an adjective is conceptually very closely related to the immediately following noun, as *big* in *big apple*, it is not considered part of the series of modifiers modifying the noun.

Thus in *...moldy, green, foul-tasting big apple ...* commas follow all of the modifiers prior to *foul-tasting*, but because *big* is closely associated with apple, it is not in the series; hence *foul-tasting* is the last modifier in the series (it could have been preceded by *and*).

Latin epithets used in scientific names for animals and plants follow a different set of rules than English names, even "official" English names. The guideline for English names is based on the rule "only proper nouns are capitalized in sentences". E.g., *coastal plain oak, raspberry horntail sawfly* would not be capitalized in a sentence. Capitalize the first letter of the first word in a sentence and capitalize the first letter for each major term in titles, figure captions, and table headings. Note: the symbol *pH* always has a lowercase *p* and uppercase *H*; it should not be the first "word" in a sentence, caption, or title if things can be conveniently rearranged.

Spell out numbers "one" through "nine"; use numerals for numbers higher than nine. As with *pH*, avoid beginning sentences, captions, and titles with a numeral.

There exist hyphens, en-dashes, and em-dashes, and each has a use. One should distinguish especially between the hyphen (the shortest of these marks) and the en-dash (the intermediate in length of the three). The en-dash should be used in two-word concepts (e.g., *nickel–metal hydride battery*) and spans of time (e.g., *for the period January–June*), among other situations. In "Word" for PCs, the en- and em-dashes are available in the "Special Characters" tab of the "Symbol" sub-menu, which is under the "Insert" menu. In Macintosh computers, the en-dash is also available directly when the "alt/option" key is held down while striking the hyphen key.

For other grammatical considerations please consult a good scientific writing reference, such as the *Scientific Style and Format: The CSE Manual for Authors, Editors, and Publishers* by Council of Science Educators Style Manual Committee.

4. Figure, Illustrations, and Table Preparation

Each table or figure should be supplied with a legend sufficiently complete to make the table or figure intelligible without reference to the text. Footnotes may be used in connection with tables and figures where necessary. Footnotes should be avoided whenever possible in the text itself. Complicated formulas should be prepared with care in a form suitable for camera copy reproduction. Avoid such formulas in the text. Acceptable fonts include Times, Times New Roman, Arial, Courier, Helvetica, and Symbol. Table and figure format should follow those in issue **79***(2)* or later.

Example Table:

Table 1. Synthesis of PIT tag retention rates from American eel studies.

Study	Location of Study	Duration	Eel Length (mm)	Tag Location	Tag Retention
Thomas (2006)	Laboratory	6 months	≥ 500	Dorsal musculature	100%
Morrison and Secor (2003)	Hudson River, NY	2 months	Mean = 457	Visceral cavity	89%
Verdon and Desrochers (2003)	St. Lawrence River, NY	1998-1999	Mean = 471.7 (1998) Mean = 468.7 (1999)	Behind the head	98%
Verdon et al. (2003)	Richelieu River, Quebec	1997-1999	Mean = 379.7	Dorsal Musculature	93.9%

Prepare figures and illustrations to be close to the expected size within the publications, with a width of no less than 3 inches (column width) or 6.5 inches for full-page width.

All illustrations and photographs will be published in black and white or grayscale. Use shaded fills for shapes and graphs. For figures with bars, shading, diagonal, and horizontal lines are allowable. Each bar fill-type should be clearly distinct. All drawn lines must be greater than 0.25 pts (0.1 mm) thick. All figures should have a white chart area. See WVAS *Proceedings* **79*(2)*** or later for example formatting.

The recommended file format and resolution for various types of line drawing and photos are:

- Black and white line art, use 1000 dpi minimum resolution
- Half tone and grayscale – use minimum resolution of 600 dpi
- Images and photos need to be in grayscale with a minimum resolution of 600 dpi

All illustrations should be submitted electronically as a separate file for each figure. Acceptable file format are TIF, PDF, Microsoft PPT, DOC, or XLS. No other formats are accepted at this time.

Please note: Illustrations, graphs, and photos that do not comply with the recommended format will be returned to the author for correction. The manuscript will not be considered for review until it is resubmitted with the required corrections. Figures and tables covering more than one page should have the figure or table number repeated at the top of each of the other pages followed by the word "continued" within parentheses. Data, legends, and other identifiers that appear within a figure or table need to be large enough in the published version to be easily read.

5. Literature Cited

References shall be collected at the end of the manuscript as "Literature Cited" and must be cited in the text.

- Citations within text:

References should be cited by author and date within the text. Separate multiple citations with a semicolon.

- Example citations within text:

Single author: (Dare 2003)
Two authors: (Buzby and Deegan 1999)
Multiple authors: (Feldheim et al. 2002)
Multiple citations: (Buzby and Deegan 1999; Feldheim et al. 2002)

- Citations at the end of paper:

The title of the papers cited and the inclusive page numbers must be given.
The article title should be italicized and the journal name should be in normal font.
Bold the volume number, italicize the issue, and present page numbers in normal font.
End each citation with a period.
Citations should be formatted with hanging indentation of 0.5".
Do not skip a line between citations.

- Example journal citations:

Buzby, K. and L. Deegan. 1999. *Retention of anchor and passive integrated transponder tags by arctic grayling.* N. Am. J. Fish. Manage. **19**(*4*): 1147-1150.

Dare, M.R. 2003. *Mortality and long-term retention of passive integrated transponder tags by spring Chinook salmon.* N. Am. J. Fish. Manage. **23**: 1015-1019.

Feldheim, K.A., S.H. Gruber, J.R.C. de Marignac, and M.V. Ashley. 2002. *Genetic tagging to determine passive integrated transponder tag loss in lemon sharks.* J. Fish Biol. **61**: 1309-1313.

Example book citation:

Stacey, M. and S. A. Barker. 1960. *Polysaccharides of microorganisms*. Oxford Univ. Press. London. 228 pp.

Freemark, K. and B. Collins. 1992. *Landscape ecology of birds in temperate forest fragments* in J. M. Hagan, III and D. W. Johnston (eds.), Ecology and Conservation of Neotropical Migrant Landbirds, pp. 443-454. Smithsonian Institution. Washington, D.C.

6. Submission of Revised Manuscripts

All manuscripts accepted by the peer reviewers that need to be revised must be done according to instructions and submitted to the editor either by e-mail or on a compact disk.

7. Proof

If galley proofs are sent to authors for corrections they should be made on margins of the proof. Proofreader's marks may be found in dictionaries and in style manuals (e.g., "Style Manual for Biological Journals"). Changes in text after the manuscript is in galley proof are quite expensive and in general are not permitted. Galley proofs must be corrected and returned promptly (within ten days).

8. Reprints

A reprint order blank will be sent with the galley proofs. This should be returned with the corrected proof.

9. Cost of Publication

Authors will be billed by the Academy for pages in excess of the maximum allowed (15 pages–see item **1**). The cost of figures that require half-tone screens, such as photographs, will also be billed to the authors. Currently, a page charge of $15.00 per page is in effect, and the author will be sent a pro forma invoice to see if payment can be secured from the author's institution, company, research grant, etc. Failure to honor page charges will not prevent publication of a paper, but will greatly assist the publication program of the Academy.