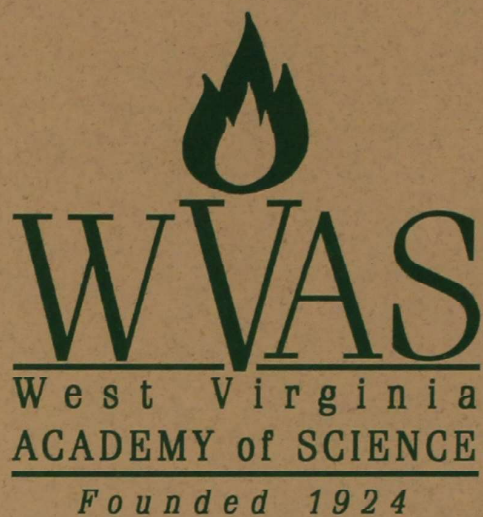


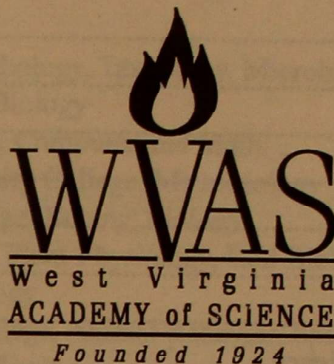
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West Virginia
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**Abstracts of the
Seventh-Eighth
Annual Session**



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BIOLOGY

JESSICA HAMMOND and **ALBERT
MAGRO**, Dept. of Biology, Fairmont State
College, Fairmont, WV 26554 and **MICHAEL
MILLER**, Dept. of Biochemistry and Molecular
Pharmacology, Robert C. Byrd Health Sciences
Center, Morgantown, WV 26506.

**Characterization of apoptosis in human
breast cancer cells.**

Experiments tested the hypothesis that the blocking of cellular lipoxygenases in MCF-7 cells inhibits growth, induces apoptosis, and modulates the transcriptional expression of Bax and Bcl-2. Lipoxygenases (Lo) were inhibited by select Lo inhibitors. 5-Lo was inhibited by REV5901, 12-Lo was inhibited by CDC, and 15-Lo was inhibited by Ebselen. The five lipoxygenase activating protein (FLAP) inhibitor, MK-886, was also used. Apoptosis was manifested by an MTT assay of growth inhibition, nuclear fragmentation, and DNA laddering. Apoptosis was also quantified by the detection of soluble cytoplasmic DNA-histone complexes resulting from apoptotic nucleosomes that are tightly bound with core histones and appear in the cytosol before the plasma membrane disintegrates. The steady-state expressions of Lo-5, Lo-12, Lo-15, and FLAP were determined by quantitative RT-PCR using a DNA Fluorometric Thermal Light Cycler. The FLAP inhibitor and the lipoxygenase inhibitors at a concentration range between 10 μ M and 30 μ M were found to inhibit growth and to induce apoptosis. It was also determined that the broad caspases inhibitor Z-VAD-FMK prevented apoptosis induced by the lipoxygenase and FLAP inhibitors.

ALISON GRIFFIN, Biology Dept., Shepherd College, Shepherdstown, WV 25443 and **CLIFFORD STARLIPER**, Fish Health Laboratory, Leetown, WV 25430. **Quarantine of pathogen-harboring *Fusconaia ebena* (mussels) prevents vectoring of the pathogen *Aeromonas salmonicida* to *Salvelinus fontinalis* (brook trout).**

The objective of this study was to determine if the required 30 days of quarantine (to prevent the spread of zebra mussels *Dreissena polymorpha*) of freshwater mussels to be relocated is sufficient for depuration of pathogens that would prevent the spread of disease. Brook trout were exposed to *Aeromonas salmonicida* by intraperitoneal injections; once these fish began to die, 200 non-infected ("clean") brook trout were added to the tank. The pathogen transferred horizontally to the clean trout and at the onset of mortality in these fish, 200 *Fusconaia ebena* were added to cohabit with the fish. After two weeks of cohabitation ten *F. ebena* were sacrificed and sampled for presence of *A. salmonicida*. The bacterium was isolated from all ten *F. ebena* sacrificed. Natural transmission from fish to mussels was demonstrated and this indicates that mussels could serve as pathogen vectors to fish. The remaining *F. ebena* were separated into five groups of 35 and placed in other tanks that were supplied with pathogen-free spring water set at 19°C. Each group of mussels was allowed to depurate for 1, 5, 10, 15, or 30 days. At the conclusion of depuration, ten *F. ebena* were tested for *A. salmonicida* and 20 clean brook trout were added to cohabit with the remaining 25 *F. ebena*. Transmission from mussels to fish was determined by fish mortality and bacterial culture of fish tissue after 14 days of cohabitation. *A. salmonicida* was isolated from *F. ebena* and brook trout from the 1, 5, and 10 day depuration groups, but not the 15 and 30 day groups. Our results show that the 30-day minimum quarantine is more than sufficient to allow depuration of a fish pathogen and to prevent the spread of disease.

BRIAN BERRY, JUDITH McKINNEY and JUDITH HALLE, Dept. of Nursing, West Virginia Wesleyan College, Buckhannon, WV 26201. **Prevention of environmental lead poisoning in Upshur County.**

Lead is a significant environmental hazard, as it can lead to learning disabilities and permanent brain damage when ingested by children. During 1999, WV State Health Department data revealed that probably 60 per 1,000 children under six years of age were poisoned with lead, resulting in Upshur County having the 2nd worst ranking out of the 55 counties in West Virginia. The two main contributing factors causing this exposure were poverty and lead paint in old homes. In 1997, CDC changed their recommendation from national universal screening to targeted regional screening in areas where > 27% of homes were older than 1977. Using these criteria, their goal was to eradicate lead poisoning in America by 2010. Unfortunately, this approach hasn't worked in Upshur County. With > 35% of the homes being older and one-third of the children living at poverty level, only 5% of them are being screened. Since a family needs to know its home's age to inform its physician, perhaps this is why tests aren't ordered. Therefore our longitudinal study and demonstration project were designed to increase public awareness and eliminate environmental lead poisoning in Upshur County by 2010. During the Fall semester of 2002, thirty Wesleyan nursing students conducted Phase I, Community Awareness, and Phase II, Universal Screening for Upshur County. This involved newspaper articles, television announcements, "Lead Screening" brochures distribution, lead paint test kits and two 10-hr poster presentations at WalMart, as well as free lead serum tests. Of the 56 recruited children, 11 actually had their blood drawn, with one revealing a borderline elevated level of 9.8 μdL^{-1} . Because of this poor compliance, Phase III for Spring Semester 2003 is a screening program for all 193 Head Start preschoolers in Upshur County.

MARK B. WATSON, Allegheny Institute of Natural History, Bradford, PA and **THOMAS K. PAULEY**, Marshall University, Huntington, WV 25755. **Turtles of the Great Kanawha River, WV.**

With many populations of turtles declining throughout North America, distributional information for these species has become more important than ever. The Kanawha River forms at the confluence of the New and Gauley rivers and drains much of central and south-central West Virginia. It flows approximately north-west through West Virginia to the Ohio River. The Kanawha River mainstem and its major tributaries were inventoried for turtles. Seven species of aquatic turtles were observed along the navigable portion of the Great Kanawha River. Over 890 turtles were captured, recaptured or observed along the 98 miles of river. Thirteen major tributaries were also examined. Turtle distribution and abundance are associated with the presence of shallow backwater areas. Midland Painted Turtles (*Chrysemys picta marginata*) were the most abundant turtles observed, making up 42% of all turtle captures. Eastern Snapping Turtles (22%) and Red-eared Turtles (21%) were the next most abundant species observed. Close to 10% of the turtles observed were Stinkpots. The least frequently observed turtles included Eastern Spiny Softshells (3.8%) and Northern Map Turtles (1.4%). One juvenile Ouachita Map Turtle was observed. This individual extends the range of Ouachita map turtles in WV from its original location close to Elizabeth, WV. This study provides important information on the distribution and abundance of turtles in an imperiled high-order stream. We have shown that the Kanawha River has a diverse turtle population and embayments along the river should be conserved as turtle habitat.

BOTANY

WILLIAM GRANTHAM, JAMES S. RENTCH and **JAMES T. ANDERSON**, West Virginia University, Division of Forestry, Wildlife and Fisheries Resources, P. O. Box 6125, Morgantown, WV 26506, **RONALD FORTNEY**, West Virginia University, Civil and Environmental Engineering, P. O. Box 6103, Morgantown, WV 26506 and **WILLIAM GRAFTON**, West Virginia University, Agriculture and Natural Resources Development, P. O. Box 6125, Morgantown, WV 26506. **Evaluation of long-lived speckled alder (*Alnus incana*) communities as probable locations for rare plant species in Canaan Valley, West Virginia.**

Habitat diversity is directly related to the environmental heterogeneity of the landscape. Generally speaking, areas of high habitat diversity tend to have greater species diversity and a greater number of uncommon or rare plant species. This is a result of a greater diversity of potentially available habitat niches. A pilot study was initiated in Canaan Valley, West Virginia in the summer of 2002 to assess the likelihood that older, established speckled alder (*Alnus incana*) shrub thickets supported rare plant species. This study was designed to gather data on habitats that may support rare species as part of a larger 3-year project evaluating the influences of nutrient availability, hydrology, seedbank characteristics, and plant community productivity on the species diversity of rare wetland plant communities. This study employed aerial photography from 1945, 1975, and 2000 to determine the locations of alder thickets that have persisted since 1945. The purpose was to assess species diversity of these communities to determine if these communities were likely locations for rare species based on their longevity. Seventeen permanent vegetation assessment plots were established: 2 in hemlock-spruce (*Tsuga canadensis*-*Picea rubens*) riparian zones, 11 in speckled alder (*Alnus incana*) communities, and 4 in bog and

fen wetland communities. Species richness and species diversity were determined for each community type. Multiple individuals of 9 rare species were located within north Canaan Valley including bog fern (*Thelypteris simulata*), a rare fern that had not been seen in the Valley for at least 30 years. In addition, results indicated that although the sampled alder communities had been in existence since 1945, the age of individual plants was much younger, indicating high turnover of individual plants. It was concluded that the high turnover of alder plants was likely due to the impact of beaver activity.

KATHARINE B. GREGG, Department of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201. **Recovery of showy lady's slippers (*Cypripedium reginae* Walter) from moderate and severe herbivory by white-tailed deer (*Oedocoileus virginianus* Zimmerman).**

Effects of and recovery from browsing by white-tailed deer (*Oedocoileus virginianus* Zimmerman) were compared in two populations of *Cypripedium reginae* Walter in West Virginia. In one site, deer removed major portions from 65-95% of the stems in a 3-year episode of severe herbivory. One year after deer were excluded, mean flowering-size stem heights were about 50% and leaf area about 73% of pre-herbivory size; no flowers were produced for two years. After grazing, percentages of subterranean and vegetative life states were high. Recovery of equilibrium life state proportions took a minimum of 8 years, while pre-herbivory mean stem heights weren't reached for 9 years. Recovery of pre-herbivory flower production level and leaf area required 11 to 12 years, but after 12 years, the number of stems above ground was only 28.5% of the pre-herbivory population size. Because it wasn't possible to separate effects of population enhancement efforts, recovery estimates may be underestimated. At the second site, where deer grazed large portions of 8-46% of the stems

during a 3-year period, equilibrium proportions of life states were not affected. Flowering ceased for only one year following the moderate grazing; pre-herbivory mean flowering-size stem height, leaf area, and flower production were restored after only two years. Stem height predicts leaf area and flowering potential. Understanding how orchids and other rare species are affected by and recover from various levels of herbivory by deer will be useful in assessing whether and how these populations can be successfully protected and enhanced.

JUSTIN HOGAN and **MARCIA HARRISON**, Department of Biological Sciences, Marshall University, Huntington, WV 25755 and **ELIZABETH MURRAY**, Integrated Science and Technology, Marshall University, Huntington, WV 25755. **Ethylene production as an indicator of stress in hydroponically-grown strawberries.**

In hydroponics systems, plant stress occurs because of nutrient build up and moisture changes in the growth media. For example, excess nutrient accumulation around the roots results in anaerobic conditions, which reduce plant growth and productivity. Anaerobic root conditions also stimulate production of the plant hormone, ethylene, in aerial tissues, altering the plant's growth and fruit development. The objectives of this research were 1) to evaluate leaf ethylene production as an indicator of stress-level and 2) to determine whether ethylene production correlates with anaerobic conditions in hydroponically-grown strawberries. The Marshall University Greenhouse houses three hydroponics systems each consisting of 10 trays (30 plants total) connected to a central nutrient delivery pipe attached to irrigation row drip tape. Ethylene in each plant was measured from a single, fully expanded leaflet which was excised and enclosed in a shell vial. After 30 min incubation, ethylene was quantified in headspace samples using gas chromatography.

Individual trays of plants were flooded to induce anaerobic conditions. Ethylene was measured at intervals during flooding and after the trays were drained. The results show that plants within specific areas of the hydroponics system have significantly increased ethylene, indicating a potential stress condition. However, flooding did not induce a large ethylene increase but a moderate increase was found after the trays were drained. Also, increased ethylene did not correlate with fluctuations in light intensity or temperature during the experimental time course. Therefore, since anaerobic conditions did not cause large changes in ethylene production, we are evaluating factors such as wounding and drought for their effect on foliar ethylene production.

ECOLOGY

MARY BETH ADAMS, USDA Forest Service, Northeastern Research Station, Parsons, WV 26287. **Nutrient budgets and diversity of a second-growth hardwood forest in the Fernow Experimental Forest.**

As part of a long-term study on soil productivity being conducted in the Fernow Experimental Forest, the biomass, nutrient capital and vegetative diversity were described on 16 forested 1-acre plots. The purpose was to thoroughly characterize the productivity and diversity of the second-growth (~90 yrs old) Appalachian hardwood stand prior to treatment to serve as a benchmark against which to evaluate effects of base cation depletion treatments. Estimates of total aboveground plant biomass ranged from 243 to 285 metric tons ha^{-1} . The majority of the aboveground nutrients were tied up in the large trees (>12.7 cm dbh), although the largest amount of nitrogen was found in the soil. For calcium, the greatest amounts were found in the large trees (1,446 kg ha^{-1}) and the forest floor or litter layer (1,121 kg ha^{-1}) with less than 200 kg Ca ha^{-1} (extractable) found in the soil. There was no

evidence of nutrient deficiency on this site prior to treatment and productivity is considered high. Average tree height on this site was 29.3 m. Vegetative diversity was also high with 22 tree species identified, and an additional 69 species of shrubs and herbs.

STEVEN L. STEPHENSON and **RANDY G. DARRAH**, Department of Biology, Fairmont State College, Fairmont, WV 26554, **ARTURO ESTRADA-TORRES**, Universidad Autónoma de Tlaxcala, Mexico, **CARLOS LADO**, Real Jardín Botánico de Madrid, Spain, **DIANA WRIGLEY DE BASANTA**, The American School of Madrid, Spain, **TATYANA KRIVOMAZ**, Solomon International University, Kiev, Ukraine and **MAYRA CAMINO VILARO**, Jardín Botánico Nacional, Havana, Cuba. **A biotic survey for myxomycetes in Cuba.**

During late November of 2002, a biotic survey for myxomycetes (plasmodial slime molds) was carried out in the montane rain forests of the Ecological Reserve "Alturas de Banao" (21° 53' N, 79° 36' W) in the Macizo Guamuahaya Mountains in south-central Cuba. Field collections were supplemented with specimens obtained from samples of bark, lianas, litter and other types of plant debris placed in moist chamber cultures. Much of the material we collected has yet to be studied in detail, and many of the cultures are unfinished, but thus far several species (e.g., *Metatruchia horrida*) have been recorded as new to Cuba. Moreover, our preliminary results confirm the rich biodiversity of this understudied area of the Neotropics and are consistent with the general patterns of myxomycete distribution and ecology already documented for various other regions of Central and South America.

MICHAEL J. DEMCHIK, retired and **VIRGINIA C. DEMCHIK**, Jefferson High School, Shenandoah Junction, WV 25442. **School ground ozone study.**

The objective of the study was to compare ground ozone content three times each day for fourteen days each in winter and spring. Each day the ozone content was measured for a period of one hour during the morning, at noon, and early evening. An ozone detecting strip was placed at a previously determined site based on prior assessments. The temperature and weather conditions were recorded each day. Data were taken and compared to a colorimeter chart and the information listed daily and compared to other readings taken that day. Preset measures determined whether or not the readings were significant. During the month of December it was found that there were only three times when the ground ozone content exceeded the 1970 Clean Air Act standards. It was also found that when the humidity is high, it is raining or it is cold that the ozone content is low. It was also found that readings were lower on weekends than during the week around school. Warm weather readings were significantly different. Ozone was higher in the evening than in the morning. It was higher in the morning than at noon. It was determined that the presence of buses during the higher rating periods bore the responsibility.

STEVEN L. STEPHENSON, Department of Biology, Fairmont State College, Fairmont, WV 26554. **Studies of Neotropical mycetozoans.**

During the period of 1995 to 2002, biotic surveys for mycetozoans (slime molds) were carried out in a number of study areas in Central and South America to document more completely the species associated with tropical forests in this region of the world. Primary emphasis of these surveys was on myxomycetes; more limited data were obtained for dictyostelids and protostelids, two other groups

of mycetozoans that share some of the same microhabitats as myxomycetes. The body of data represented by the more than 8,000 field and moist chamber collections of myxomycetes accumulated during these surveys has provided evidence for a number of ecological patterns not previously reported for myxomycetes. The most important of these are that (1) both overall abundance and species richness of myxomycetes appear to be lower in tropical forests than in temperate forests, (2) species richness and (especially) relative abundance increase with decreasing moisture conditions, and (3) in tropical forests, distinct assemblages of myxomycetes are associated with microhabitats that have no counterparts in temperate forests. Most of the dictyostelids recovered from samples collected in the various study areas are cosmopolitan forms or species known to have tropical or subtropical affinities, whereas the species of protostelids associated with Neotropical forests appear to be the same as those found in temperate regions of the world.

BRUCE EDINGER, Department of Bioscience, Salem International University, Salem, WV 26426, **MISAKI HORIBA**, Guardians of the West Fork Watershed and **TIM CRADDOCK**, West Virginia Department of Environmental Protection, Charleston, WV 25304. **Application of WVSOS Citizen's Monitoring Protocols to low-order stream assessment in the West Fork watershed.**

Most low-order streams in West Virginia have not been evaluated for overall quality and benthic macroinvertebrate community status, largely because reliable and rapid methods that can be performed by relatively untrained personnel remain elusive. EPA-approved protocols require several hundred invertebrates per sample, identification to genus, collecting permits, laboratory analysis, highly trained personnel, and large budgets, precluding their use for most volunteer organizations. However, extensive stream status data is important for

detection of impairment and may be useful for 305(b) reports written annually by states for the EPA. Between May and July of 2002, chemical, physical and biological parameters of sixteen possibly impaired streams within the West Fork watershed were sampled using revised WVSOS Level 3 methods to evaluate streambed and streambank habitat quality and benthic macroinvertebrate bioassessment ratings as part of a watershed inventory. About 200 benthic macroinvertebrates were collected per site and identified to morphofamily to allow calculation of %EPT abundance, taxa richness, EPT richness, modified HBI index, % tolerant, % dominance and overall stream index. Fifteen of the 16 streams rated marginal or poor, indicating high sensitivity of a citizen protocol to identify impaired conditions. The modified HBI, %EPT, % tolerant and EPT richness (a sample size-sensitive metric) had the highest correlations with overall stream index values. Habitat quality ratings correlated poorly with benthic macroinvertebrate metrics. Specific trade-offs between low and high sample size and between low and high taxonomic levels of identification were identified.

JOHN C. LANDOLT, Department of Biology, Shepherd College, Shepherdstown, WV 25443, **STEVEN L. STEPHENSON**, Department of Biology, Fairmont State College, Fairmont, WV 26554 and **JAMES C. CAVENDER**, Department of Environmental and Plant Biology, Ohio University, Athens, OH 45701. **Dictyostelid cellular slime molds from Australia.**

Little published information is available on the abundance and distribution of dictyostelid slime molds in Australia. During the 2001 and 2002 field seasons, samples of soil/litter were collected from several localities in Queensland and the Northwest Territory of Australia. Some samples were obtained from the ground and others from the soil/litter material associated with the bases of vascular epiphytes on the

trunks and branches of forest trees ("canopy soil"). All samples were processed by means of the standard methods used to isolate and recover dictyostelid cellular slime molds. Many of the forms isolated could be assigned to described species, but a number of isolates have not yet been assigned and some of these may represent species new to science.

JAMES RENTCH, RONALD FORTNEY and **WILLIAM GRAFTON**, West Virginia University, Morgantown, WV 26506, **HAROLD ADAMS**, Dabney S. Lancaster Community College, Clifton Forge, VA 24421, **ROBERT COXE**, Western Pennsylvania Conservancy, Pittsburgh, PA 15222, and **STEVEN STEPHENSON**, Fairmont State College, Fairmont, WV 26554. **Site-vegetation relationships for West Virginia roadside plant communities.**

Roads are high-light, disturbed habitats that are often planted with non-native species and maintained in an early successional stage. This study examined site-vegetation relationships for 287 plots along 11 major four-lane highways in West Virginia. We used analysis of variance to determine whether there were significant differences in mean species richness, diversity and evenness among highways, and among plots categorized as cut, fill or on-grade. We used multiple response permutation procedures (MRPP) to determine whether roadside plant community composition differed significantly by highway and by highway position. Finally, we contrasted the fidelity of species occurrence by highway and by highway position using indicator species analysis. US 50 had the highest species richness (19.3), evenness (0.78), and diversity (2.26), while I81/US340 had the lowest values (11.7, 0.57, and 1.40, respectively). However, when highway position was considered, there were no significant differences in these indices. Results of MRPP suggest that different highways may be characterized by somewhat distinct vegetation

assemblages. This hypothesis was supported by indicator species analysis: 54 species showed a statistically significant ($p < 0.05$) affinity to one highway over others. When highway position was considered, no significant differences in community composition were found between groups, and indicator species analysis found only 25 species that exhibited a significant affinity to one type of position.

CHEMISTRY & ENGINEERING

SONJA ARNOLD, West Virginia Wesleyan College, Buckhannon, WV 26201 and **REBECCA SUNDERMAN**, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **HPLC detection and comparison of caffeine in diet pills, tea and soft drinks.**

Diet pills and weight-loss supplements are rampant in our society. Stimulants are often used as appetite suppressants, a common one being caffeine, $C_8H_{10}N_4O_2$. Using HPLC techniques, quantitative comparisons of caffeine content in diet pills, herbal diet pills, soda and tea were performed.

CHARLES BATTLESON, SHANNON GLASPELL, MIKE CAMPANELLI, NICK FREDRICK, PAUL KREITZER, MICHELLE LECHLITER, CHRIS SUNDERLIN, BRIANNE WILLIAMS and **JOHN KUHLMAN**, Department of Mechanical and Aerospace Engineering and **DONALD D. GRAY**, Department of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. **Magnetic control of bubble motion in microgravity.**

Evaporative spray-cooling for high power electronics or lasers in space is a challenge when dealing with microgravity conditions. Since there is no dominant body force such as gravity to produce buoyancy, vapor bubbles that

form may remain on the heat-rejection surfaces rather than float away due to buoyancy. This would reduce the heat-exchange rates and could cause burnout or damage the surface that needs to be cooled. The experiment being designed investigates one possible method for repelling the vapor bubbles on a heat rejection surface. In the presence of a nonuniform magnetic field, a body force, known as the Kelvin force, is exerted on all magnetically permeable materials. Diamagnetic and paramagnetic fluids are repelled from and attracted to magnetic fields, respectively. This unheated experiment will use the magnetic Kelvin force to control the position of diamagnetic air bubbles in a paramagnetic liquid (simulated coolant). The fluid to be used will be an aqueous solution of manganese chloride. In late July, 2003, the team will travel to Johnson Space Center to perform the experiment aboard a KC-135 through the NASA Reduced Gravity Student Flight Opportunities Program. The KC-135, known as the *Weightless Wonder*, creates a microgravity environment for periods of about 25 seconds by flying in parabolic arcs. Experimental results will be presented that demonstrate observable effects of the magnetic Kelvin force on bubble trajectories in normal Earth gravity.

JIBEN ROY, Department of Bioscience, Salem International University, Salem, WV 26426 and **STEVE WOLFE, MADHU SANGA** and **PATRICK CALLERY**, Department of Basic Pharmaceutical Sciences, School of Pharmacy, West Virginia University, WV 26506. **Modern medicines from traditional sources: investigation of a mixture of *Allium sativum* (garlic) and *Nigella sativum* (black cumin).**

In order to find out the chemical constituents responsible for antimicrobial effects of a traditional medicine containing extracts of garlic and black cumin, a detailed study using GC-MS, HPLC and antimicrobial activity was undertaken. Allicin (as well as disulfides) in the garlic water extract and thymoquinone,

p-cymene, *p*-*tert*-butylcatechol, pinene and α -phellandrene in the volatile oil of black cumin are responsible for the antimicrobial activity of the two medicinal herbs/spices. Preliminary antimicrobial testing suggested that the mixture of the two herbs/spices has relatively stronger effects on both *Staphylococcus aureus* and *Escherichia coli*. Further studies are on the way to determine the molecular-level antimicrobial efficacy.

WAYNE DANIEL and **VICTOR W. DANIEL**, Department of Mathematics, West Liberty State College, West Liberty, WV 26074. **A simple model for estimating bulk properties of an MHD Channel.**

A simple model is developed and used to estimate the bulk plasma/slag properties of a magnetohydrodynamic (MHD) channel directly from routine electrical measurements taken during a load sweep. All data used in this study came from the last test series of the 1A4 channel at a Department of Energy (DOE) facility in Butte, MT. The 1A4 channel was the centerpiece of the national MHD effort in the early 1990's, but was subsequently dismantled in 1994 after DOE funding priorities shifted from clean-coal technologies to environmental technologies during this period. Starting with the component form of Ohm's law - the basic constitutive equation that relates the current density J , the electric field E , the fluid velocity U and the magnetic flux density B - the x and y components are averaged in a novel way over a one-pitch control volume at each electrode position. The resulting equations are accurate enough to permit weighted averages of the critical plasma/slag properties to be calculated directly from electrical measurements taken at each electrode position over a load sweep under mild assumptions, namely that the plasma/slag properties are constant and the electrical properties are linear functions of the load current, I , over a load sweep. The calculated bulk conductivity at each electrode position

under power-generation conditions matches reasonably well the measured bulk conductivity under pre-power conditions (magnetic field off). The other bulk properties calculated by this model — the (weighted-average) Hall parameter, the (weighted-average) effective resistivity and the two nonuniformity factors — cannot be compared to direct measurements since none exist for either the pre-power or power conditions. However, the bulk properties do agree reasonably well with theoretical results obtained from advanced 2D and 3D models when adjusted for the presence of a slag layer in the bulk averages.

JAMES SNIDER II, JOHN LOTH and GARY J. MORRIS, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506. **Steel mill utilization of zinc-pot bearing material wear data.**

There are currently over 50 galvanizing lines in operation in the United States producing approximately 50 million tons per year of galvanized sheet metal. Frequently zinc-pot hardware fails, which causes production delay, resulting in an economic loss. It takes approximately three hours to change the zinc-pot bearings at a downtime cost of \$1,600 hr⁻¹. To predict the performance of the submerged bearings, a large number of variables must be considered. These variables include pot chemistry, temperature, line speed and line tension. With these variables it is possible to develop a design guide for sheet mill operators to determine the most cost effective selection of zinc-pot bearing materials and coatings, which will not be the same for all galvanizing lines. The objective of this project is to measure wear rate of submerged zinc-pot bearing materials as a function of contact pressure and velocity. A small, laboratory-size testing machine was developed for this purpose. This machine measures the wear of bearing material samples, submerged in a cup of zinc, in the form of a

1-inch diameter ball rotating against a matched ball seat. The seat and ball can be cast or machined using bearing materials from a test matrix. The seat is placed in a temperature-controlled molten zinc bath where load, torque and RPM of the test samples are measured and recorded. From the measured torque the sliding friction coefficient of the bearing materials tested can be calculated. By measurement of the seat radius before and after testing, the wear rate of the material as a function of contact pressure and velocity was determined.

VIJAYALAKSHMI TUMMALA and DONALD D. GRAY, Department of Civil and Environmental Engineering, College of Engineering and Mineral Resources, West Virginia University, Morgantown, WV 26506. **Hydrology of the Beaver Creek watershed using the Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS) model.**

The Beaver Creek watershed, Tucker County, West Virginia, is heavily affected by historical mining activities. The proposed Corridor H highway section from Davis to Bismarck would pass through the watershed, disturbing these mined lands, exacerbating the already-impaired water quality conditions, and significantly altering the hydrology of the watershed. The present study was carried out to characterize the baseline hydrology of the watershed through computer modeling. Hydrologic modeling of the Beaver Creek watershed was implemented using the Corps of Engineers' Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS) program. The options used within the HEC-HMS model include a Soil Conservation Service (SCS) Type II design storm for a 24-hour duration, the SCS Curve Number method to estimate the rainfall abstractions, an SCS Dimensionless Unit Hydrograph as the transfer function and the Muskingum-Cunge method for reach routing. Watershed parameters, such as sub-basin areas

and area-weighted curve numbers, were estimated using ArcView GIS to delineate the sub-basin boundaries. The times of concentration for the sub-basins were estimated using the SCS lag formula. Stream reach lengths were estimated using a Digital Elevation Model (DEM) prepared by West Virginia University Natural Resource Analysis Center (based on a USGS 30 m x 30 m DEM). The channel slopes were estimated using the USGS 30 m x 30 m DEM. Stream cross-section data were collected in the field. The results of this study are predictions of direct runoff hydrographs at 26 locations along Beaver Creek for return periods ranging from 1 year to 100 years. The predicted peak flows increase from 1,396 cfs for a 1-year storm to 11,649 cfs for a 100-year storm.

ALAN D. SMITH, Department of Management and Marketing, Robert Morris University, Pittsburgh, PA 15219. **Data capture systems technologies and innovation: a review of the academic and practitioner trends.**

Many industrial e-commerce applications rely on multiple technologies to fully implement a system. Data collection and integration strategies are essential to enterprise resource management (ERP) systems as well as warehouse management systems. AIDC-related systems are probably the most widely used and under-recognized IT strategic assets in the modern global economy with data collection and integration strategies that are essential to ERP systems as well as warehouse management systems. As people become increasingly dependent on data to do their jobs and as they increase the amount of work done outside the traditional office, a series of working models of data integration and automated data collection methods are needed in the strategic manufacturing IT literature. Websites, automatic identification, data capture-related systems and associated scanning equipment provide not only a direct contact between the

organization and its customers, but also present an opportunity for innovation in both the delivery and selling of products and services. AIDC-related systems, and their associated authentication and safeguard protocols, are the essential building blocks for sustainable competitive advantages and superior profitability. Typically, in radio frequency applications unwired LANs are unbounded. Wire LANs, such as those used in bar coding systems, use RS-232 and related formats, with each network node having a unique media address and all nodes listening to the data traffic. Without these technologies and safeguards, e-commerce as we know it simply would not exist. The relatively easy application of the software wedge, for example, the simplest method of data collection which emulates keystroke on a standard workstation located between the scanner and CRI, can reduce data errors and speed up communications many orders of magnitude over human data entry methods.

JEFF KEATON and **RONALD FORTNEY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506 and **TODD GROTE**, Department of Geology and Geography, West Virginia University, Morgantown, WV 26505. **Guidance for geomorphic assessments for stream restoration projects in the unglaciated Appalachian Plateau physiographic province.**

Engineering projects to rehabilitate riverine ecosystems, commonly called "stream restoration," are becoming increasingly common throughout the U.S. and Europe. In fact, many states now require stream impact mitigation as an element of 401/404 permits for construction projects. Practitioners in the stream restoration field are often civil engineers who have little training or knowledge of the natural geomorphic processes that control stream "morphology," or form. Consequently, design methodologies often result in projects that are designed without

regard to channel-forming processes. Streams are complex systems that are inextricably related to regional and local geology, soils, climate, land use, and vegetation. Region-specific guidance is needed by the engineering community on how to assess these factors for specific projects. A geomorphic analysis can provide sufficient information on the past, present, and potential stream conditions and provide a basis for sound engineering design.

SAM LAMONT, ROBERT ELI, RONALD FORTNEY and DONALD GRAY, Department of Civil and Environmental Engineering, West Virginia University, WV 26505. **A hydrologic analysis and model of a wetland in Canaan Valley State Park, West Virginia.**

The Canaan Valley, located in the northern mountains of West Virginia, is the largest area of inland freshwater wetlands in the Appalachian mountain region. Small, isolated wetlands within the 5,000 ha valley often support many rare plant species. One such area is Abes Run wetland, in the southern end of Canaan Valley State Park. A comprehensive hydrologic study is being conducted within the approximately 135 ha Abes Run sub-basin to aid in the protection and management of the area's rare plants. This concurrent study includes the analysis of: the gradient of the local water table using two-inch, screened groundwater wells installed throughout the wetland, stream discharge using a V-notched weir and an automated water level logger, simulated potential evapotranspiration, and meteorological conditions such as air temperature, relative humidity, precipitation, and solar radiation, gathered from a nearby weather station. Also, a digital terrain model has been created from 5-foot contour, Canaan Valley State Park Service topographic maps using geographic information systems for analysis in a semi-distributed watershed catchment model, TOPMODEL. The model allows for the analysis of the spatial relationship between the area's rare plants and

other factors such as soil type and local geology. Finally, the model will be used to predict stream discharge and water table elevation. This study will provide information necessary for the environmental protection and management of the wetland. The hydrologic analysis will allow for the prediction of the wetland's reaction to future events such as floods or droughts as well as the effect of human influences such as the road, which bisects the outlet. The results of this study may be applied to future studies in the northern end of Canaan Valley.

DEEPAK MEHRA, JOHN L. LOTH, GARY J. MORRIS, GEORGE M. PALMER and RICHARD GUILER, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506. **Venturi-type acoustic signal amplifier.**

This paper describes the anticipated performance of an acoustic sensor to identify the locations of leaks in natural gas transmission pipelines. Natural gas is one of the major sources of energy in the United States and elsewhere in the world. Natural gas is supplied from field processing units to cities through transmission lines, most of which are steel pipelines. There are currently enough miles of gas transmission lines in the United States to wrap around the world twenty times. Transmission lines operate at high pressures. The pressure drop due to friction requires installation of pumping stations at regular intervals driven by a natural gas burning turbine or reciprocating engine. A problem always plaguing the gas transmission industry is rapid detection of leaks important to minimize energy losses and to prevent catastrophic explosions. Leaks in gas pipelines can be caused by corrosion, overstress, landslide or infringement by an excavator (often called third party damage). Infringement damage may not be noticed and later on could develop corrosion in stress fractures. The occurrence of a leak (or damage that may actually lead to a leak)

generates an acoustic signal. This acoustic signal travels through the pipeline wall and through the gas. To positively identify a leak one could correlate signals from at least two sources, one could be a ramp function associated with the loss of fluid or by the acoustic signature associated with the leak. This paper describes an acoustic signal amplifier (Venturi type) built at WVU acoustic lab, designed to measure low dB acoustic pressures and able to operate at high pressures.

BRIAN L. CRAWFORD, West Liberty State College, West Liberty, WV 26074. **Assessing land use/land cover changes in the Upper Ohio Valley using Landsat TM and ETM+ data.**

This project is the first stage of a planned program intended to describe correlations between land use/land cover (LULC) and economic/demographic changes in the Upper Ohio Valley region using multispectral data collected by sensors on Landsat satellites. In this phase of the program, data from June 3, 1986 (Landsat 5) and June 23, 2002 (Landsat 7) were subjected to Principal Component Analysis (PCA) and unsupervised classification methods to create LULC classification maps and associated statistical summaries. Twelve LULC classes were identified and compared for the two data sets. While it might have been expected that the spatial extent of urban LULC areas in this region would remain essentially unchanged during this period of slowed economic activity and population loss, comparison of the classifications actually showed a growth of urban LULC during this 16-year time period of approximately 2 percent and much more significant changes in classifications associated with vegetation types. It appears that even with a shrinking human population the region is experiencing spatial increases in its urban areas and that the uses of rural land are changing. While specific correlations between economic/demographic changes and LULC have

not yet been established, the spatial expansion of anthropogenic LULC changes in the region is apparent.

PSYCHOLOGY & SOCIAL SCIENCE

KATRINA HULL, MIKITA WEAVER, ANDA WEAVER, and JOHN HULL, Department of Psychology, Bethany College, Bethany, WV 26032. **Responses of church-related and other web sites to the terrorist attacks of September 11, 2001.**

To assess the responses of church-related and other web sites to the September 11, 2001 terrorist attacks in the U.S., sites containing the words "church," "Christian," and "September 11" were compared with sites containing the words "September 11" but not the word "church" using Netscape Search® (Google, Inc.). Regarding September 11, 2001, chi-square analyses showed that church-related sites were significantly more likely to use words such as forgiveness, prayer, faith, reconciliation, and consolation, while other sites were significantly more likely to use words like retaliation, revenge, justice, and cowardly. This study not only provides evidence of different kinds of response to September 11, 2001 by the two types of web sites defined, but describes a methodology for others wishing to conduct similar studies, using advanced web-searching techniques, for research or class demonstrations.

NORA DILLARD, DANIEL MERRITT, and MICHAEL CHOBAN, Department of Psychology, West Virginia Wesleyan College, Buckhannon, WV 26201. **Cellular phones and the effect on motor coordination.**

This study examined driving performance on a video game to determine if driving errors would increase with increasing levels of distraction. A between group experimental design was used. Using random assignment without replacement,

subjects were assigned to one of five conditions: (1) no distraction, (2) talking—no phone, (3) no talking—hold phone, (4) talking—hands-free phone, (5) talking—hold phone. The subjects engaged in a trial run on the video game for pre-training purposes. Subjects were then tested in their assigned experimental condition and their number of errors were recorded. The no distraction group made significantly fewer errors than all other groups, but there were no significant differences among the various distraction groups.

RISÉ STRAIGHT, Department of Political Science, West Virginia Wesleyan College, Buckhannon, WV 26201. **The United States government and clean, renewable energy: why more is not being done.**

This paper explores United States government support of renewable energy technologies. It questions why there is a lack of support, and explores possible hypotheses through several sub-questions. By examining monetary support, current energy usage, environmental and economic costs and benefits, and public opinion, conclusions were drawn to provide an understanding of government support. The federal energy budget was examined, as well as the National Energy Policy, in order to determine levels of support. The research determined that there is indeed a lack of government support of renewable energy technologies. Reasons such as energy company interests and lack of public opinion contribute to the low level of support from the government. Further research topics are suggested to increase the amount and substance of information available in the area of government support of renewable energy.

SUSAN ANDRZEJEWSKI, EMILY COKELEY, MAGGIE KUHN, and JOHN HULL, Department of Psychology, Bethany College, Bethany, WV 26032. **The effects of siren and light use on viewers' perceptions of emergency vehicles.**

Individual research participants sat six ft from a 21-inch diagonal viewing screen and watched 10-sec videotapes of an ambulance traveling 45 mph in one of four conditions: no lights, no siren; lights, no siren; no lights, siren; lights and siren. All videotapes involved the same ambulance driven by the same person traveling under identical road and weather conditions. After viewing the videotape, each participant filled out a questionnaire that assessed memory for information presented in the videotape, and asked for an estimate of the ambulance's speed to the nearest mph. One-way analyses of variance showed that in conditions involving the use of a siren, participants' ambulance speed estimates were significantly higher, as were their error rates for videotape information they tried to recall. These results have important implications for the use of siren and lights on emergency vehicles.

WESLEY JARRELL II, Department of Political Science, West Virginia Wesleyan College, Buckhannon, WV 26201. **Relating children's human rights to poverty.**

This paper analyzes the effects of poverty on children's rights as they are embodied in currently relevant international legislation. The goals of the work are: (1) to raise awareness of the fact that children's rights are universally valid and, thus, cannot be ignored, (2) to provide a more organized, or categorical, way of looking at children's rights in order to facilitate a broader, yet more focused understanding of how circumstances of poverty affect those rights' substantive realization, and (3) to inspire serious, educated discussion about solutions to what the paper reveals as an engrossing problem. To that end, the work's structure breaks roughly into three sections: (1) a brief look at the cultural relativism/universalism debate as it pertains to children's rights, (2) an analysis of the rights system and poverty's effects on it, and (3) a short list of theories and ideas meant to orient a discussion of solutions.

The highlight of the paper, and its key analytical tool, is an unprecedented categorization of children's rights as they have been presented in crucial international agreements made through the United Nations. The paper also depends upon second-hand statistics, U.N. committee and commission documents, and the affirmation of other scholars to bolster its points. The work concludes rather predictably, that poverty is a worldwide problem and that children are its most vulnerable victims—a dire situation, since these beings constitute the world's future. The work also provides an overall picture of the interconnectedness of children's and human rights, as well as the inadequacy of some approaches to this problematic area.

MEGAN CLEGG, JOSEPH KRAYNOK and RICHARD CALEF, Department of Psychology, West Virginia Wesleyan College, Buckhannon, WV 26201. **The resilience of the partial reinforcement effect through extinction and continuous reinforcement in rats using food reinforcement.**

The partial reinforcement effect (PRE) is when subjects receiving a reward following the target response each time [continuous reinforcement (CRF)] during acquisition show less resistance to extinction (no rewards available) than subjects only receiving rewards following the response some of the time [partial reinforcement (PRF)]. The purpose of the study was to determine if the PRE would be sustained through subsequent CRF trials (received by both groups) and long or short periods of extinction. In the experiment, rats traversing the straight runway for food reinforcement were randomly placed into four groups: CRF-SE, which was given continuous reinforcement and short extinction, PRF-SE, which experienced partial reinforcement and short extinction, CRF-LE, which consisted of continuous reinforcement and long extinction, and PRF-LE, which received partial reinforcement and long extinction. The PRE was sustained through CRF and extinction, regardless of the length of

extinction, suggesting that the length of the extinction period has little or no effect on the PRE.

EDUCATION

JOHN HULL, JAY FOSTER, and MICHELLE STREET, Department of Psychology, Bethany College, Bethany, WV 26032. **Web-based research in a Human Sexuality class.**

Students completing the Human Sexuality course at Bethany College must conduct empirical research in a sexuality area of their choosing. That research requires a final write-up, including statistical analysis of data gathered. Recently, students have been encouraged to relate that research to their academic major, and to use web-based sources of information. For example, an economics major conducted a correlational study of countries' fertility rates related to their gross domestic product per person; a political science major analyzed countries' laws on abortion as a function of their type of government; a psychology major correlated a variety of sociocultural variables with states' AIDS rates. Results of these and other projects will be discussed, along with procedures designed to foster this web-based research in a variety of academic settings.

ANDREAS BAUR and ERICA HARVEY, School of Science and Mathematics, Fairmont State College, Fairmont, WV 26554. **Teaching general chemistry group, outcome and mastery-based - a preliminary report.**

The general chemistry courses for science majors, Chemical Principles I and II, were completely restructured and taught in the new format during the academic year of 2002-03. The new course structure is based on the mastery of clearly-defined program-supported learning outcomes, which will be shared during

the presentation. The course incorporates active learning techniques, including collaborative learning activities, and is enhanced through WebCT. Our goals were to make student learning goals the focus of the course, to increase student awareness of the extent and limitations of their own understanding and skill at all points during the course, to accommodate different learning styles and learning paces, to improve overall student learning, retention and attitudes, and to align instructional strategies, assignments and tests. In addition, different assessment tools were integrated into the course structure. Surveys assessing the students' attitudes and learning were administered. Overall, the retention rate was similar to previous years. The percentile on the California Diagnostic Test improved significantly. The attitude towards chemistry improved slightly. Our ability to prepare external accreditation documents improved dramatically.

WILDLIFE BIOLOGY

W. MARK FORD, JENNIFER M. MENZEL, JANE L. RODRIGUE, USDA Forest Service, Northeastern Research Station, Parsons, WV 26287 and **M. ALEX MENZEL**, Division of Forestry, West Virginia University, Morgantown, WV 26506. **Hearing bat habitat: Anabat surveys on the Fernow Experimental Forest.**

We used Anabat II acoustical detectors linked to laptop computers to sample bat echolocation activity at 57 permanently-located recording stations on the 1,800 ha Fernow Experimental Forest in Tucker County, West Virginia. During the summers of 2001 and 2002, we detected *Myotis lucifugus*, *M. septentrionalis*, *M. sodalis*, *Eptesicus fuscus*, *Pipistrellus subflavus*, *Lasiurus borealis*, *L. cinereus*, and *Lasionycteris noctivigans*. Logistic regression analyses suggested that *M. septentrionalis* and *M. sodalis* activity was linked to small canopy gaps or closed forest conditions along small 2nd

order streams, whereas *M. lucifugus* and *P. subflavus* activity was highest along larger 3rd to 4th order streams with discontinuous or open forest canopies. *L. borealis* and *E. fuscus* activity was greatest in medium-sized forest canopy gaps and linear openings along roads in upland conditions. *L. cinereus* activity was most noticeable within recently harvested forest stands, although its presence also was recorded above mature forest canopies and along forested riparian zones. Except for *E. fuscus* and *P. subflavus*, logistic regression model performance linking individual species presence to habitat conditions was good with medium to high sensitivity and specificity measures. Multivariate ordinations of bat echolocation activity indicated some foraging habitat segregation based on morphology, echolocation characteristics and feeding strategy that minimized inter-specific competition. Although roost habitat management for species such as *M. sodalis* remains the conservation priority on the Fernow, maintenance and management of foraging habitats that we identified also should be considered a critical task.

DAVID A. HELON, JAMES T. ANDERSON, West Virginia University, Wildlife and Fisheries Resources Program, Division of Forestry, Morgantown, WV 26506, and **CHRIS P. DWYER**, Ohio Division of Wildlife, Crane Creek Wildlife Research Station, Oak Harbor, OH 43449. **Investigation of home range, habitat use, and movements of river otters in the Killbuck Watershed, Ohio.**

River otters (*Lontra canadensis*) are important components of riparian systems and also are an important fur-bearing species. Our study objectives were to determine home range, habitat use, and movements of river otters in the Killbuck Watershed located in northeastern Ohio. The Killbuck Watershed encompasses a 157,730 ha wetland complex, which makes it the largest wetland complex in Ohio aside from the Lake Erie marshes. Using radio telemetry,

we tracked 7 river otters (3 females and 4 males) from May through August of 2002.

Approximately 50 locations were taken for each river otter during this season. River otters also were monitored once a month for a 24-hour period with locations taken every 3 hours. The sample size was increased to 13 otters during the fall of 2002: 5 females and 8 males. The adaptive kernel method was used to estimate home ranges. Preliminary results suggest that female river otters have a home range approximately half the size of males. Home ranges and movements show more of a polygon shape forming within the wetlands rather than linear movements following stream systems. However, males appear to use riverine systems to access different wetland systems more often than females. This information will improve our ability to scientifically manage river otters in Ohio and the Upper Midwest and Great Lakes Regions.

THOMAS K. PAULEY, Department of Biology, Marshall University, Huntington, WV 25755 and **MARK B. WATSON**, Allegheny Institute of Natural History, University of Pittsburgh at Bradford, Bradford, PA 16801.
Birds of the Great Kanawha River.

Several studies on the diversity of bird species on the Kanawha River have been conducted over the past 127 years. The first known bird study in Kanawha County was conducted by W.D. Scott in 1872. This study listed 112 species of birds that could use the Kanawha River for nesting, foraging or migratory routes. In 1973, Gluck and Handley compared birds they observed on the upper Kanawha Valley with those listed by Scott. In this current study, we examined species that use the Kanawha River mainstem (approximately 97 miles from its beginning at Gauley Bridge to the mouth at Point Pleasant), the riparian zone, embayments and major tributaries from May 19, 1999 to August 2, 2000. One hundred and twenty-seven species were observed. Ninety-seven species were observed on the main stem, 85 in

embayments, and 60 in tributaries. Thirty-one species were permanent residents and 65 summer residents. We confirmed 18 nesting species and 12 were new nesting records.

HARLEY W. WEAVER, JAMES T. ANDERSON and **JOHN W. EDWARDS**, Wildlife and Fisheries Resources Program, Division of Forestry, West Virginia University, Morgantown, WV 26506 and **TOM DOTSON**, West Virginia Division of Natural Resources, Point Pleasant, WV 25550. **Investigating fundamental dissimilarities in both physical and behavioral attributes between nuisance and non-nuisance black bears in southern West Virginia.**

Nuisance black bear (*Ursus americanus*) activity is increasing annually in southern West Virginia due to rising bear populations coupled with the availability of human refuse. Efforts are currently underway to understand nuisance activity and possible management strategies to curb unwanted behavior. Since 1996, approximately 271 individuals were examined, tagged, radio collared, and cataloged including subsequent follow-ups on denning females. Body mass ($p < 0.001$) and girth ($p < 0.001$) were greater for nuisance males than for non-nuisance males. Mass to girth ratios generated strong associations ($r^2 = 0.90$) within each group. A description of female den sites demonstrated variation among local individuals and those reported from other eastern regional populations. Average age of nuisance activity varied among groups ($p < 0.001$). Analysis of hunter induced mortality data indicated nuisance males are less susceptible to conventional harvest techniques compared to all other groups. Appropriate management strategies were evaluated to promote higher harvest rates for nuisance males. Few relocated nuisance males (22.9%) repeated nuisance activity, but most nuisance males (83.4%) released at the site of capture repeated nuisance behavior. Understanding both the physical and behavioral aspects among nuisance and non-nuisance black

bears may offer managers more efficient conditioning techniques to curb nuisance behavior.

JENNIFER M. MENZEL, W. MARK FORD, and **JANE L. RODRIGUE**, USDA Forest Service, Northeastern Research Station, Parsons, WV 26287, **JOHN W. EDWARDS** and **M. ALEX MENZEL**, West Virginia University, Division of Forestry, Morgantown, WV 26505. **Ecology and natural history investigation of the Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*).**

Little is known about the ecology and habitat requirements of the endangered Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*) within its distribution in the central Appalachians of West Virginia. To gain insight into the habitat requirements of this subspecies, we analyzed nest trees and habitat use of Virginia northern flying squirrels radio tracked during the summer and fall of 2000 and 2001. Results of the 59 nest trees analyzed indicate that the squirrels change nest trees frequently. Sixty-nine percent of the nests were in cavities and 31% were leaf nests. Yellow birch (*Betula alleghaniensis*), black birch (*B. lenta*), Fraser magnolia (*Magnolia fraseri*) and American beech (*Fagus grandifolia*) were selected for nest trees more than expected. A large portion of nest trees were in larger and taller trees than trees in the surrounding area. There also were a significant number of trees located next to or near skidder and hiking trails. Results from the habitat use analysis show that the Virginia northern flying squirrels preferred spruce and mixed hardwood-spruce over areas of hardwoods and open space at multiple spatial scales. The information gained in these analyses is being used to build a model to predict high quality Virginia northern flying squirrel habitat. This model can be used to prioritize high quality habitats for restoration and conservation.

POSTERS

PSYCHOLOGY & SOCIAL SCIENCE

JESSICA BOLTON and **HILLARY TYGRETT**, Department of Psychology, West Virginia Wesleyan College, Buckhannon, WV 26201. **The effect of within-group cooperation and between-group competition for reinforcement in a classroom setting on test performance.**

During the course of the fall semester, two general psychology sections were administered identical exams based on class notes and chapter readings from an assigned textbook. The 9:00 class, which served as the experimental group, was randomly divided into two groups, which competed against each other for a five-point bonus added to the test score of the group with the highest average. The 10:00 class was not divided and was not offered the five-point bonus and thus served as the comparison group. The groups were pre-tested and shown to be equal in test performance prior to treatment. It was hypothesized that between-group competition for reinforcement and within group cooperation would increase students' test scores overall in the class that received the treatment. Pilot studies done prior to this experiment led to this hypothesis. However after treatment in the present study, the experimental class did not achieve significantly higher class test averages than the comparison group, suggesting that the competition and/or cooperation contingencies did not have an effect ($p > 0.05$). The data from this between-groups design were analyzed using an independent samples t-Test. It is concluded that variations in methodology should be used to replicate this study. Significant results in replications could have many practical implications.

KRISTA PEARS and RICHARD CALEF,
Department of Psychology, West Virginia
Wesleyan College, Buckhannon, WV 26201.
**Delay of reinforcement effect in extinction on
human subjects.**

The present study investigated whether human subjects performing under a partial delay of reinforcement are more resistant to extinction than those receiving immediate reward or constant delays of reinforcement. Also, the effect of one stimulus presentation vs. continuous stimulus presentation in extinction was observed. Students from West Virginia Wesleyan College were randomly assigned to one of six groups in a between-group design. Students were assigned to either immediate reinforcement, partial delay, or constant delay conditions in either the continuous stimulus or one stimulus presentation in extinction treatment. Although the statistical analysis showed no significance between the groups or the stimuli conditions in extinction, the finding that human subjects receiving partial delay were more resistant to extinction than those receiving constant delay or immediate reinforcement with only the one stimulus trial presentation approached significance. Because the results approached significance, the study should be replicated with some minor changes.

**STEVEN SHAFFER, SCOTT C.
McCLARIN, and PATRICK DROHAN**,
Institute for Environmental Studies, Shepherd
College, Shepherdstown, WV 25443. **Jefferson
county greenways GIS study.**

The Jefferson County Greenways is a policy-planning tool to identify and conserve an integrated, countywide system of greenways that encompasses county cultural and environmental landscapes such as the Appalachian Trail, the Shenandoah and Potomac rivers, wetlands, and significant historical features as strategic building blocks in a greenways system. Design criteria and critical thresholds were established

for landscapes and human use to assist in the construction of the greenway and to avoid further ecological and cultural degradation. Comments from members of the local environmental and GIS community were incorporated in a consensus-based ranking system, whereby a numerical value was assigned to each of thirty three GAP landform types, indicating relative value as a member of two data sets; an ecological greenway, and a cultural greenway. Least cost routing was used to designate an optimal design for both ecological and cultural uses, resulting in a weighted grid showing those landforms that were best suited for ecological and cultural preservation. Connections were based on assessments of potential sites and surrounding features as well as current resource conservation and recreation usage. The Jefferson County Greenways study has proven to be a useful policy-planning tool for both local government and NGO organizations.

SARA WEST and JOHN TOTH, Department
of Sociology, West Virginia Wesleyan College,
Buckhannon, WV 26201. **A cultural critique
of Barbie.**

This project evaluated the enculturated gender roles of women and an analysis of cultural messages and objects. Barbie, it is argued, represents the idealized images of femininity. She portrays a woman's perfect body and what all little girls should aim to be. She is the young girl's hero. Barbie was made to be a girl's toy, a doll that every girl will ask for. In fact, there is an average of at least 8 in every household. Barbie polarizes the differences between the boy and girl. To analyze Barbie and associated media messages, this study used Bem's Enculturated Lens Theory which identifies three areas of gender formation: Gender Polarization, Androcentrism, and Biological Essentialism. It describes gender roles as distinctly defined by society. Furthermore, Barbie was scrutinized according to the concept of the oppositional

code. Under this concept the original meaning(s) of a cultural object is reframed within an alternative context. In this case, the idealized portrayal of beauty, body type, etc. is reframed within a new context of domestic violence. Domestic violence Barbie is a version of the beautiful plastic doll that represents thousands of abused women who suffer continuously from the cruelty of a loved one. Domestic violence Barbie represents those who are afraid to leave because of no place to go or punishment she might receive if caught. She brings to life the harsh realities that women must face every second of every day around the world. The socio-cultural implications of this reframed meaning are discussed using the enculturated lens theory.

EDUCATION

DANA CALICA, MELINDA HUFF, ADAM WOLFE and ANDREAS BAUR, School of Science and Mathematics, Fairmont State College, Fairmont, WV 26554.

Demonstrations for general chemistry.

A group of freshmen chemistry majors collaborated to prepare chemical demonstrations for the general chemistry course for science majors and for visits to high schools. The goal was to involve the chemistry majors early in their career in activities that support their interest in chemistry and the formation of a group spirit among our majors. Students located appropriate chemical demonstration procedures from the literature. In some cases, video tapes were used. The focus was on demonstrations that attract the attention of the audience (e.g., oscillating reactions, chemiluminescence), demonstrations that can be shown without good ventilation and safety features in the room (e.g., iodine clock reaction, vanishing ink, sun setting reaction) and more dangerous demonstrations involving the reactions of metals that were used to support descriptive chemistry outcomes in the general chemistry course (e. g. reaction of

aluminum with bromine, antimony with iodine, combustion of magnesium and calcium). The poster will overview the chemistry and dramatic effect of the demonstrations attempted and present details of selected successful demonstrations. Simple demonstrations will be shown. Handouts with procedures will be provided.

JENNIFER LEIGH and REBECCA SUNDERMAN, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Exploring the kinetics of tributyl phosphate hydrolysis in the undergraduate laboratory.**

Phosphate compounds are an integral part of life. Scientists add dipotassium phosphate to antifreeze to control its pH and produce athletic drinks with monopotassium phosphate, which prevents muscle cramps after exercise. We encounter phosphate derivatives in such things as chicken tenders, french fries, car wash detergent, toothpaste, and bath beads. Perhaps most profound are the roles phosphorus plays in the structure of DNA and the natural progression of ecosystems. Because every person will encounter a phosphate derivative at some point in his/her life, any research that enhances knowledge of phosphate reactivity is vital to scientific advancement and efficiency. Having experience with phosphate chemistry is rapidly becoming a key attribute that leads to acceptance into graduate programs. A tributyl phosphate hydrolysis study is a prime candidate for an undergraduate laboratory exercise for many reasons. The chemicals involved can be obtained at low cost, they pose low health risk upon exposure, and the procedure can be performed within the three- to four-hour time allotment. Students will gain experience with refluxing, standardization, and titration techniques. A reaction between tributyl phosphate and potassium hydroxide is initiated in a DMSO/water solvent with heat. The reaction is quenched at various time intervals, and the excess base is titrated with hydrochloric

acid. Analysis of such data reveals the amount of unreacted tributyl phosphate at each time point. Thus, the rate of the reaction can be determined. Trials indicate that the hydrolysis of tributyl phosphate follows a pseudo-second-order reaction rate.

BIOTECHNOLOGY

RACHEL BELL and DONNA FORD-WERTZ, Department of Biology, West Virginia University, Morgantown, WV 26506. **A taxonomic analysis of *Allium tricoccum* s.l.**

This research evaluates conflicting taxonomic treatments of the ramp (*Allium tricoccum* s.l.) that exist in the scientific literature. Statistical multivariate analyses are being performed on morphological characters from herbarium collections throughout the distribution range to test for significant clustering. A common garden plot has been created to examine environmental influences on phenotype. Breeding-system, cross-pollination and germination studies are being conducted to aid in the interpretation of character differences. Our goal is to assess classification alternatives, revealing biological evidence for a single or separate species. We will test the hypothesis that the ramp is two species, as proposed by Jones in 1979.

C.J. BROADWATER, CARLY GEORGE, HEATHER McABEE, STEVE STEPHENSON, and MARK FLOOD, Department of Biology, Fairmont State College, Fairmont, WV 26554. **Classification of plasmodial slime molds using DNA sequence data from the large subunit ribosome gene.**

The current classification of plasmodial slime molds (myxomycetes) is based largely upon morphology (e.g., size and color of the spore mass, overall structure of the fruiting body,

presence or absence of lime or a capillitium). Using genetic analysis it is possible to determine if these morphological differences accurately reflect how closely related different species of myxomycete are to each other. The objective of this study was to determine whether myxomycetes currently classified in different orders are also genetically related in the same way. DNA was extracted from sonicated spores and specifically amplified using the PCR (polymerase chain reaction) procedure. DNA sequences from the large subunit (LSU) ribosomal gene were compared. In general, the genetic data from the organisms studied agrees with current classification. However, there are instances where species from the same order appear to be more closely related genetically to species in other orders. Therefore, it is concluded that genetic analysis of myxomycetes will yield a different classification system than the one currently used as well as providing additional insight into the evolution of these important members of decomposition pathways.

LI CHEN, RANGARAJ NANDAKUMAR, PATRICK LAI and SUZANNE M.D. ROGERS, Department of Bioscience, Salem International University, Salem, WV 26426. **Engineering the wetland monocot *Juncus accuminatus* (Rush) using *Agrobacterium tumefaciens*.**

Our long-term goal is to express viral genes in wetland monocots, whose gene products can be used as oral vaccines against infectious agents, such as the avian-transmitted West Nile Virus. The objective of this study was to develop a protocol for establishing a model transformation system for the monocot *Juncus accuminatus* (Rush) via *Agrobacterium tumefaciens*. Three plasmids, pTOK233 in *Agrobacterium* strain LBA4404, and pCAMBIA-1201 and pCAMBIA-1301 both in EHA105, were used to transform *J. accuminatus*. All plasmids contained *uidA* and *hptII* genes within their T-DNA region. Seedling-derived calli were used

as explants. Transformed calli were selected on MS media containing 40 or 80 mg L⁻¹ hygromycin for 12-15 weeks. Shoots were then regenerated and rooted on MS medium containing 6-benzylamino-purine (BA) and naphthaleneacetic acid (NAA), respectively. To date 39 lines of transformed plants have been selected and established in the greenhouse.

Expression of the *uidA* gene was demonstrated by histochemical GUS assay of calli, the F0 primary transformed plants and F1 progeny seedlings. The presence of the *uidA* and *hptII* genes in transformed plants was confirmed by the polymerase chain reaction (PCR). To our knowledge this is the first report of *J.*

accuminatus transformation by any method, plant establishment in the greenhouse, and stable inheritance of transgenes in progeny. In conclusion, the wetland monocot *J. accuminatus* was transformable with *A. tumefaciens* and transgenes were inherited.

CARLY GEORGE, C.J. BROADWATER, HEATHER McABEE, STEVE STEPHENSON, and MARK FLOOD, Department of Biology, Fairmont State College, Fairmont, WV 26554. **Comparison of different methods of DNA isolation from myxomycete spores.**

Genetic analysis of myxomycetes (plasmodial slime molds) is important for developing a better understanding of the role these organisms play in decomposition pathways. Objectives of this study were (1) to determine the best method for breaking open myxomycete spores and (2) to develop the most time- and cost-efficient method for extracting DNA from spores. Spores from *Stemonitis fusca* were broken open by either sonication or bead beating (mixing with glass, silica, and zirconia beads). Both methods were found to work, because DNA extracted from sonicated and bead-beaten samples produced PCR products, but sonication techniques were more time efficient. Sonicated spores from five different species were extracted

by one of the following kits: (1) Promega's Wizard SV kit [\$1.25/extraction], (2) CPG's DPG-Mini kit [40 cents/extraction], (3) Epicentre's MasterPure kit [75 cents/extraction], and (4) Qiagen's QIAamp kit [\$1.50/extraction]. PCR products were obtained from all samples extracted using the CPG and Qiagen extraction kits, but extractions using the Epicentre or Promega's Wizard column-based kit were unsuccessful. Therefore, our data indicate that sonication coupled with the CPG extraction kit represent the best method for extracting DNA from myxomycete spores.

KRYSTAL KOLOZY and TONEY E. MORRIS, Department of Biology, Fairmont State College, Fairmont, WV 26554. **Examination of mutagenic potential of common environmental substances or exposures as measured by bacterial reverse mutation (AMES TEST).**

The objective of this research project was to examine everyday exposure of humans to artificial sweeteners in drinks and coffee. The AMES test was used to assess mutagenic potential. The AMES test is commonly used to determine the mutagenic and possible carcinogenic potential of substances and is usually the first test performed on substances to help determine whether substances are carcinogenic. The substances tested included distilled water, the negative control, and 4-nitro-o-phenylenediamine (4-NOPD), the positive control. The artificial sweeteners used were aspartame (Equal®), sucralose (Splenda®), and saccharine (Sweet-N-Low®). Ground light roast coffee and dark roast coffee beans also were used. The substances to be tested were autoclaved prior to analysis to insure sterility. In the AMES test, mutagenesis colonies appear on the petri dish for substances testing positive. These colonies were counted and the data recorded. A positive response from a substance or combination of substances indicates that a carcinogenic potential may exist and, in turn,

may result in people developing some types of cancer. Limiting or avoiding these substances may lead to a healthier life style and a reduction in cancer risk.

HEATHER McABEE, CARLY GEORGE, C.J. BROADWATER, KRISTAL KOLOZY, JODI FORTNEY, STEVE STEPHENSON, and MARK FLOOD, Department of Biology, Fairmont State College, Fairmont, WV 26554.
Comparison of *Physarum confertum* (myxomycete) specimens using genetic analysis.

Using genetic analysis it is possible to determine how closely related specimens are to each other. The objective of this study was to determine if different specimens of the myxomycete, *Physarum confertum*, collected from adjacent study plots in Tucker County, West Virginia, were clones or just closely related members of the same species. Spores were broken open by sonication and DNA was extracted using a solution-based DNA kit from Promega. DNA was amplified from either (1) a conserved region of the large subunit (LSU) ribosome gene or (2) a more variable internal transcribed spacer (ITS) region between ribosomal genes, using specific primer pairs for the PCR (polymerase chain reaction) process. The results from the LSU gene sequences indicate that several *Physarum confertum* specimens appeared to be clones of one another. However, using the ITS sequences, the same specimens were found to be simply closely related members of the same species. Therefore, our data show that it is important to utilize more variable regions for comparisons of closely related individuals of this species.

DONALD McCLELLAND and DONNA FORD-WERTZ, Department of Biology, West Virginia University, Morgantown, WV 26508. **The genus *Platanthera* (Orchidaceae) in WV.**

Platanthera (Fringed Orchids) is the largest genus of the Orchid family in West Virginia. It consists of ten species including two hybrid species and one species with two varieties. These were previously classified in the genus *Habenaria*. The taxa are distinguished primarily by characters of leaf position, leaf number, flower color, and lip petal features. This research includes study of literature references and specimens in the West Virginia University Herbarium. The objective is to produce a revised treatment for the next edition of the Flora of West Virginia. This will include an updated identification key, new descriptions, and a review of geographic, ecological, and phenological data.

RANGARAJ NANDAKUMAR, LI CHEN AND SUZANNE M.D. ROGERS, Department of Bioscience, Salem International University, Salem, WV 26426. ***Agrobacterium*-mediated transformation system of the wetland monocot *Typha latifolia* (broad-leaf cattail).**

An *Agrobacterium*-mediated model transformation system was standardized for the wetland monocot *Typha latifolia* to achieve our long-term objective of introducing candidate genes for phytoremediation. Two binary plasmid vectors pCAMBIA1301/EHA105 and pTOK233/LBA4404, containing the 35SCaMV promoter-driven GUS and *hptII* genes were used for transformation. Fifty-day-old, picloram-derived (5 mg L^{-1}) calli, cultured under dark or light environments, were co-cultivated for three days and then transferred to MS medium supplemented with timentin (400 mg L^{-1}) to kill the *Agrobacterium*. They were then selected on medium containing 20 or 40 mg L^{-1} hygromycin. Resistant calli were regenerated on MS medium containing 5 mg L^{-1} of 6-benzylamino-purine (BA) under continuous light, with or without 20 or 40 mg L^{-1} hygromycin and with or without charcoal (10 g L^{-1}). Shoots were rooted on half-strength MS salts with or without 20 mg L^{-1}

hygromycin. In addition, different components of regeneration systems and direct transfer of co-cultivated calli to regeneration media were also tested. Transient GUS activity averaged 36 and 41%, for pCAMBIA1301 and pTOK233 transformed calli, respectively. Hygromycin-resistant calli, selected after three months, showed stable GUS expression. Integration of *hptII* and GUS genes in hygromycin-resistant transgenic calli were confirmed by PCR and PCR-Southern analysis. A total of 46 plants were regenerated and established in the greenhouse of which 13 have shown stable GUS expression either in leaf or root tissue. The integration and expression of transformed genes will be confirmed through PCR, Southern and Western analysis. In conclusion, *T. latifolia* could be genetically transformed through *Agrobacterium*.

E.O. OMOLO, S.H. GARRETT, D.A. SENS, M. MILLER and V. GUREL, Department of Biochemistry, West Virginia University, Morgantown, WV 26508. **Differential expression of *Hsp 70A*, *70B*, *70C* and *Hsc 70* genes in human breast epithelial cell line, MCF-10, exposed to cadmium.**

Heat shock proteins (Hsp) and cognate heat shock proteins (Hsc) genes are induced by a variety of agents such as heat shock, heavy metals and chemical agents. The expression of *hsp 70* and *hsc 70* mRNA and protein were determined in human breast epithelial cell line (MCF-10) exposed to lethal and sublethal concentrations of Cd²⁺ (7, 14 and 30 μM) to see if expression of metallothionein-3 (often expressed in breast cancer) would alter expression. The acute exposure was modeled by exposing confluent cultures of MCF-10 for 0, 2, 4, 12, 24, 36 and 48 hr. Reverse transcriptase-polymerase chain reaction was used to determine the expression of inducible *hsp 70A* and the cognate *hsc 70* genes. There was an induction of *hsp 70A* by cadmium but the cognate isoform remained at basal levels. The response of these two genes was not altered by the expression of metallothionein-3.

JULIE RENNER and BEN B. WHITLOCK, Department of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201. **The role of oxidants in programmed and stress-induced cell death in plants.**

Programmed cell death, or apoptosis, is important in the control of cellular responses to environmental stress and infection. Plant cells will undergo apoptosis in response to stressors such as extremes in temperature, touch, wounding and pathogens. Reactive oxidants play a prominent role in this process in mammalian cells; therefore, we sought to investigate their role in plant cell death. For this purpose we exposed excised 5-6 day old cucumber cotyledons to various stressors and incubated them at 25°C. After incubation, the cotyledons were assayed for characteristic DNA fragmentation by agarose gel electrophoresis, a hallmark of cell death. Heating the cotyledons at 55°C for 20 min was the best death stimulus tested. Preliminary results suggested that this process was due to oxidants since the anti-oxidant compound MnTBAP inhibited the heat-induced DNA fragmentation. Exogenous addition of the oxidant compounds hydrogen peroxide and tert-butyl hydroperoxide (10 mM) also induced significant cell death with higher concentrations (100 mM) causing a complete breakdown in DNA structure. However, we were unable to prevent these effects with anti-oxidant compounds. Interestingly, we found that a significant amount of DNA fragmentation occurred in the 24 hr control samples as well, indicating that cell death may occur spontaneously in this tissue. This process was inhibited by MnTBAP. In addition, we are working to establish an infection model using the fungus *Botrytis cinerea*, a pathogen that initiates a hypersensitive cell death process and uses this to spread throughout the plant. We have established infection in post-harvest apples by inoculation with a *B. cinerea* spore suspension. Preliminary results suggest that treatment with MnTBAP delays infection. This indicates that *B. cinerea* induces an oxidant

response to stimulate cell death and raises the exciting possibility that some plant infections may be inhibited by anti-oxidants.

JUSTIN SANDERS, Department of Biosciences, Salem International University, Salem, WV 26426. **Efficacy of caffeine as an antibiotic.**

The objective of the study was to determine if the common plant alkaloid caffeine has any antimicrobial effect on *Enterococcus faecalis* (ATCC 19433) and *Staphylococcus epidermidis* (ATCC 12228). There has been evidence that there is a potent antibacterial component present in coffee after acidification and ethyl acetate extraction. The 'natural' decaffeination process uses ethyl acetate as the solvent of extraction. A Kirby-Bauer method was utilized at first but problems were encountered with caffeine's low solubility in water and incorrect preparation of the sensitivity discs. To replace the disc sensitivity test, a selective agar test was used. Sodium citrate was added to overcome caffeine's solubility problem. The results showed that caffeine has activity against *S. epidermidis*. An MIC was performed next and showed that caffeine has an MIC of 25 $\mu\text{g mL}^{-1}$. It can be concluded that caffeine has a definite antibacterial effect towards *S. epidermidis*. Earlier trials indicated that the gram-negative organism *Escherichia coli* was resistant to caffeine. The present results show that *E. faecalis* is also resistant towards caffeine. More research needs to be done to see if caffeine is an effective antibiotic against nonenteric gram-positive pathogens like MRSA.

SHIRISHA YELAMANCHILI and KAMAL A. MALIK, Department of Molecular Biology, Salem International University, Salem, WV 26426. **A model system for developing oral anthrax vaccine production in transgenic plants.**

The potential virulence factors of *Bacillus anthracis* are a poly-D-glutamic acid capsule and a three-component protein exotoxin (protective antigen - PA, lethal factor and edema factor). Among these proteins, the subunit-protective antigen can be manipulated for its medical usage in vaccination purposes to immunize humans against anthrax. Currently available vaccines are not considered safe due to undesirable side effects. At the same time, for proper protection an individual requires multiple immunizations over a long period of time and yearly boosters as well. Our research project describes development of an effective vaccine against anthrax in transgenic plants. Plant-based vaccines are free of human or animal diseases and production of oral vaccines can readily solve the problem of repeated booster immunizations. The main objective of our research is to clone the PA gene (provided by S. Leppla) into *Arabidopsis thaliana* and create a model system for gene expression in plants. The primers for the PA gene were designed and amplified by PCR using plasmid pXO1 of *Bacillus anthracis* as a template. The gene is being cloned in plasmid pCAMBIA2300 and will be transferred in *Agrobacterium* strain GV3101 through triparental mating. The results of transformation and level of gene expression of anthrax subunit PA gene will be discussed.

ENVIRONMENTAL SCIENCE

ZACHARY S. DRAGAN and JEFFREY A. SIMMONS, Biology Department, West Virginia Wesleyan College, Buckhannon, WV 26201. **A comparison of water quality and land use relationships in the Buckhannon River watershed using Geographic Information Systems (GIS).**

A typical watershed encompasses a large amount of land, resulting in a large amount of chemical input to the water resources. The uses of the land within a watershed can have a profound impact on the quality of the water in

streams. An example of this would be a stream flowing near a field used for agricultural purposes. The stream, through groundwater movement and precipitation runoff, would be subject to the addition of excess nutrients, pesticide residues, and sediments from erosion. Some other land use factors affecting water quality are acid mine drainage, municipal wastewater treatment, and runoff from city storm drains. Geographic Information System mapping can help organize and compare the large amount of data that is collected in a watershed. The focus of this study was to determine if surrounding land use (e.g., percent agricultural land) has an effect on the fecal bacteria concentration in tributaries in the Buckhannon River watershed. Data on fecal coliform concentrations in streams and land use were gathered from the Environmental Protection Agency, the West Virginia Department of Environmental Protection, and several other sources. Data gathered were organized using ArcView GIS 3.3 software. Our results showed that percent agricultural land use was not correlated with fecal coliform concentration in streams in this watershed.

DANIEL C. EADES, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. **A longitudinal analysis of the Berkeley County landfill.**

In order to protect the state's resources, the West Virginia Department of Environmental Protection has undertaken a project to cap landfills no longer in use to prevent their contents from entering and damaging surface and ground water resources important to the health of wildlife, West Virginia residents, and the economy. This paper examines the first in a three-phase plan designed to quantitatively assess the closure of the Berkeley County Landfill located in the eastern panhandle of the state. The research focuses on geological trends of the site and an evaluation of the surface water surrounding the site, as well as on-site ground

water, for pH, conductivity, and concentrations of dissolved Mn, Al, Cd, and Fe, which will be used to assess the landfill's current impact on the Opequon Creek and a tributary, as well as provide insight into the effects of the closure process. Results do not provide sufficient data to confirm any negative impact to the surrounding environment at this time, but do reveal the limitations of the study parameters, especially in regards to dissolved metal analysis, and suggest ways that this and future studies may be improved.

MICHAEL M. LORANTY and **JEFFREY A. SIMMONS**, Department of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201. **A study using GIS to determine the effects of National Forest designation on water quality.**

The objective of this study was to determine whether streams within the boundaries of the Monongahela National Forest (MNF) have better water quality than streams outside of the Forest's boundaries. The MNF is located in eastern West Virginia near the border of Virginia. Streams within the forest were compared to outside streams within the state of West Virginia. Data on fish and macroinvertebrate populations collected by government agencies were used to assess water quality of chosen streams. The results were used to determine if the factors associated with the National Forest such as land cover and management practice created better water quality than current conditions elsewhere in the state. This information could be used to manage streams for increased water quality statewide. Data were collected in electronic format from several government agencies including the WV Division of Natural Resources and the WV Department of Environmental Protection. Data from a West Virginia Stream Condition Index (SCI) prepared for the U.S. EPA were also used. The data were organized and mapped using ArcView GIS. A t-test showed that SCI values

were significantly greater in MNF streams than in exterior streams suggesting that these streams were healthier.

JUDITH VOJIK and JEFFREY A. SIMMONS, Department of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201. **Effects of logging on stream width-depth ratios, streambed embeddedness, and substrate composition in the Fox Run Watershed, WV.**

This study was carried out in the Fox Run Watershed that was recently timbered from September to November 2002. The first objective was to collect data that represented changes along Fox Run below the logged area to determine whether the activity had a significant impact on three stream characteristics. The second purpose was to create a map of the Fox Run stream channel morphology. Width-depth ratios, streambed embeddedness, and substrate composition were measured in early March along approximately 200 meter sections of stream, one below the timbered area and a reference section along a second branch of Fox Run that was not logged. The Wolman Pebble Count was used to measure the substrate composition of the streambeds to determine if the stream was aggrading, degrading or at dynamic equilibrium. Width-depth ratios were measured every twenty meters at ten points across transects expanding the bankful width of the stream. Embeddedness was measured using the WV Save Our Streams (SOS) Bioassessment Survey every four meters within twenty-meter segments and averaging the scores for each stream branch. Our results indicate no significant difference in width-depth ratios, streambed embeddedness, nor substrate composition between logged and undisturbed stream reaches up to one month after logging.

SARAH WENNERBERG and DONNA FORD-WERTZ, Department of Biology, West Virginia University, Morgantown, WV 26506. **Propagation and field testing of native West Virginia plant species for roadside revegetation.**

This research investigates methods of revegetation on existing and newly constructed roadsides using West Virginia native species. These native plants could potentially replace the West Virginia Department of Highways current species list that contains only non-native species. *Sabatia angularis* (Rose pink) and *Baptisia tinctoria* (Yellow false indigo) will be tested in the greenhouse to find suitable germination procedures. They will also be seeded in roadside plots to study field germination and relative growth (by non-destructive weight measurement). *Rhus aromatica* (Aromatic sumac) and *Vitis vulpina* (Winter grape) cuttings will be examined in the greenhouse under +/- rooting agent. Plant height, root weight, and root production (yes or no) of each individual will be measured. Cuttings will be planted on steep, dry roadside slopes to test the effects of aspect and AM fungi on relative growth and survival. Soil will be characterized (soil type, pH, temperature, and moisture) at each site. All propagules will be collected from West Virginia roadsides. This project promotes the use of native species for restoration in order to reduce the spread of non-native species and prevent future invasions.

CHEMISTRY, PHYSICS & ENGINEERING

JASON BEST, Astronomy and Physics Group, Institute for Environmental Studies and **SARA MAENE**, Information Technology Services, Shepherd College, Shepherdstown, WV 25443. **A study of galaxy morphology-evolution relationships using the MORPHS and Dressler galaxy cluster catalogs.**

Standard Euclidean geometry is, at times, an incomplete description of the universe. In such cases, fractal geometry can and has served as an alternative, and often superior, tool for analyzing aspects of nature. Using a method known as the pointwise dimension (which is based in fractal geometry), we have been able to study how different types of galaxies cluster and evolve with respect to their environments. We have examined 55 nearby galaxy clusters and 10 distant galaxy clusters, focusing on the environments of three morphological types of galaxies: ellipticals, lenticulars, and spirals. We have found few significant differences in environments among the different morphological types. This suggests that while environment may be a factor in galactic evolution, it is not necessarily a primary factor. We also present computational models we have developed of various clusters. These models are an invaluable aid to astrophysical research.

LAUREN JONES and REBECCA J. SUNDERMAN, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Animal testing and the chemicals in shampoo.**

Many personal hygiene products contain labels boasting, "Not tested on animals". Twelve shampoos have been compared based on pH, number of ingredients, declarations on the bottle and the ratio of irritant chemicals to non-irritant chemicals.

BETHANY HUFF and STEVE K. JOHNSON, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Determining the presence of pesticides on produce samples.**

Produce samples of lettuce, strawberries, and kiwi were tested for the presence of common pesticides (vinclozolin, imidacloprid, and captan). These pesticides were mixed with

several solvents to determine the best solubility. Then samples were analyzed using gas chromatography with and without preconcentration by solid phase extraction to determine the best analysis method. The best detection limits were observed using gas chromatography alone, without solid phase extraction or any preconcentration. Produce samples were rinsed in solvent to remove pesticides and the rinse was injected directly into the gas chromatograph. The lettuce and kiwi samples were found to contain trace amounts of captan, while none of the pesticides observed were found on the strawberries.

JAROD KABULSKI, MICHELLE WAGGY and ANDREAS BAUR, School of Science and Mathematics, Fairmont State College, Fairmont, WV 26554. **Investigations towards novel tetrathiafulvalenes.**

Tetrathiafulvalenes and phthalocyanines are important building blocks in the preparation of electroactive compounds and conductive materials. The long-term goal of the presented project is the synthesis of compounds that are a combination of a phthalocyanine with tetrathiafulvalene moieties. These novel compounds could show interesting optical and electrochemical properties that can be tuned by the size of the pi-system and the formation of phthalocyanine-metal complexes. The poster will show results from the first attempts in the synthesis of novel 4,5-benzo-4',5'-dicyanotetrathiafulvalene derivatives that are the precursors for the proposed phthalocyanines. As a model the synthesis of 4,5-benzo-4',5'-dicyanotetrathiafulvalene was pursued. Benzyne was formed from the diazotization of anthranilic acid followed by a thermal fragmentation. The addition reaction with carbon disulfide and methanol formed 4,5-benzo-2-methoxy-1,3-dithiol, which was converted into 4,5-benzo-2-methoxy-1,3-dithiolium tetrafluoroborate upon treatment with tetrafluoroboric acid. Reaction with

triphenylphosphine and tributylphosphine, respectively, resulted in the formation of the corresponding phosphonium salts. *In situ* formation of the 4,5-benzo-1,3-dithiol-2-ylidene phosphorane was established by reaction with triethylamine. The Wittig reaction with 4,5-dicyano-1,3-dithiol-2-tione resulted in the formation of a bright purple-pink colored substance, whose spectroscopic properties indicate its identity to be 4,5-benzo-4',5'-dicyanotetrathiafulvalene. An attempt to produce a derivative by following the same sequence starting from 3-iodoanthranilic acid failed.

VERA V. PAWLOWSKI and REBECCA J. SUNDERMAN, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Phase transition study of $\text{NaBi}_3\text{V}_2\text{O}_{10}$**

Single phase powder samples of $\text{NaBi}_3\text{V}_2\text{O}_{10}$ were prepared, identified with powder X-ray diffraction data and analyzed thermogravimetrically. The data indicate that only one phase is present in the temperature range 100°C to 450°C.

ECOLOGY & ZOOLOGY

RANDY G. DARRAH, C. J. BROADWATER, HEATHER McABEE, MARK R. FLOOD and STEVEN L. STEPHENSON, Department of Biology, Fairmont State College, Fairmont, WV 26554, **DENISE BINION**, USDA Forest Service, Morgantown, WV 26505; **ANGEL M. NIEVES-RIVERA**, Department of Marine Sciences, University of Puerto Rico, Mayagüez, PR 00681 and **ADAM W. ROLLINS**, Division of Forestry, West Virginia University, Morgantown, WV 26506. **A quest for myxomycete DNA in Puerto Rico.**

During June of 2002, specimens of myxomycetes (plasmodial slime molds) and samples of dead plant material (primarily lianas and other types of aerial litter) for isolation of these organisms in moist chamber cultures were collected from a number of study areas in Puerto Rico. These included the El Verde LTER site in the Caribbean National Forest, Rio Abajo Commonwealth Forest, Toro Negro Commonwealth Forest, and Rio Camuy Cave Park. This collecting trip represented one component of a major study of the distribution, ecology, and biodiversity of myxomycetes in Neotropical forests. The study, which began in 1995 and will continue until at least 2004, is designed to include undergraduates from Fairmont State College as active research participants, and three undergraduates (AWR, CJB and HM) were involved in this most recent trip. One goal of the overall study is to apply the techniques of modern molecular biology to investigations of the population biology and genetic relatedness of some of the more common species of myxomycetes (e.g., *Arcyria cinerea*, *Didymium squamulosum*, and *Physarum compressum*) associated with Neotropical forests. A major emphasis of the trip was obtaining specimens from which DNA could be extracted for laboratory analysis.

DANIEL B. JOHNSON and STEVEN L. STEPHENSON, Department of Biology, Fairmont State College, Fairmont, WV 26554. **Myxomycetes recorded from three localities in southern California.**

Samples of bark from living trees (*Yucca brevifolia*, *Juniperus californica*, *Pinus flexilis*, and *Pinus murrayana*), dead cacti, coarse woody debris, and various types of ground litter were collected from (1) Joshua Tree National Park, (2) Mount San Jacinto State Monument, and (3) the Blue Mountains Wildlife Preserve in southern California. These study areas range in elevation from 375 m to 2,580 m and represent three very different types of vegetation. The

samples were used to prepare a series of 49 moist chamber cultures for isolation of myxomycetes (plasmodial slime molds). Values of pH obtained for the cultures varied rather widely (4.1 to 8.1), with those prepared with samples of dead cacti having the highest pH (mean = 7.1) and the bark of *P. murrayana* the lowest pH (mean = 4.4). Myxomycetes recorded to date include a number of species that are either rare in West Virginia or not yet known from the state. Examples include *Badhamia gracilis*, which was exceedingly common in moist chambers prepared with samples from Joshua Tree National Park.

SARAH KELLER, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. **Assessing the validity of pollination syndromes using *Lonicera japonica* and *Mimulus ringens*.**

Many plants are commonly thought to have collections of floral traits, called "pollination syndromes" that make plants better adapted to distinct groups of pollinators. Recent data, however, have found discrepancies between the predicted pollinators and those that appear to exert more selective influence through reproductive success. In this study, two plants in Clarke County, Virginia were tested for conformity to their pollination syndromes. *Lonicera japonica* (Japanese Honeysuckle) has characteristics consistent with a nocturnal hawkmoth pollination syndrome and *Mimulus ringens* (Square-stemmed Monkeyflower) follows a bee pollination syndrome. Visitor effectiveness was tested using measures of visitor frequency, pollen deposition and fruit set following single visits to virgin, emasculated flowers. Hand pollinations revealed that fruit set in *L. japonica* was pollen limited and was not in *M. ringens*. In addition, *Lonicera japonica* was not self fertile, while *M. ringens* was. Sweat bees were the most frequent visitor to *L. japonica*, while the expected pollinators (hawkmoths) were not observed during

experimental periods. However, nocturnal stigmas received as much pollen and fruit set as diurnal stigmas, suggesting that nocturnal pollinators are more effective visitors on a per-visit basis. The most common visitor to *M. ringens* was *Bombus*, although other pollinators were also observed. The most effective at pollen deposition of *M. ringens* were *Bombus*, but these bees may contribute disproportionately to self pollination via transfer of pollen between flowers within a plant. Pollination syndromes do not appear to accurately reflect all pollination interactions in these plants and should be used with discretion.

ERIN R. LAWRENCE and **JEFFREY A. SIMMONS**, Department of Biology, West Virginia Wesleyan College, Buckhannon, WV 26201. **A comparison of *Acer rubrum* leaf decomposition in treated acid mine drainage and reference streams.**

Acid mine drainage (AMD) has the potential for devastating, long-term effects on streams and their aquatic life. The effects include low pH and a high concentration of heavy metals, including manganese, iron, and aluminum. Treated AMD streams maintain a higher pH along with lower concentrations of these heavy metals. However, treated AMD may still have an adverse effect on organism function and survival, particularly macroinvertebrates. In this experiment, our objective was to monitor leaf decomposition rates in treated AMD and reference streams to determine mass loss of bagged red maple leaves in a six-week incubation period. The initial mass of the leaves in each bag was weighed before distribution. Three streams were used in each experimental stream category, and nine bags were placed in each stream for incubation. After distribution, three bags of leaves were collected from each stream in two-week intervals on three different collection dates. The leaves were rinsed thoroughly, dried, and again weighed to determine the rate of mass loss over the number

of incubation days. After 4 weeks of incubation the mass loss in treated AMD streams was no different from that in reference streams. However, the incubations will continue for a total of 9 weeks.

JOSHUA H. LEWIS and STEVEN L. STEPHENSON, Department of Biology, Fairmont State College, Fairmont, WV 26554.
Myxomycetes associated with the aerial litter microhabitat in northern Queensland, Australia.

A primary microhabitat for myxomycetes in Neotropical forests is represented by aerial litter (dead but still attached plant parts) but little is known about comparable microhabitats elsewhere in the world. The purpose of the present study, which is still ongoing, is to investigate the assemblages of myxomycetes associated with aerial litter microhabitats in tropical forests of northern Queensland, Australia. Samples of aerial litter collected from a number of study sites and at heights ranging from near the forest floor (1–2 m) to the upper canopy (> 35 m) were used to prepare a series of 56 moist chamber cultures. Study sites included the Australian Canopy Crane Research Facility at Cape Tribulation, the School for Field Studies Research Station near Yungaburra, and the Australian Tropical Mycology Research Centre near Kuranda. Values of pH recorded for the moist chamber cultures ranged from 4.2 to 7.6 (mean = 6.5), and 41 of the 56 (73%) cultures have yielded some evidence (either plasmodia or fruiting bodies) of myxomycetes. Among the species recorded thus far are *Arcyria cinerea*, *Diderma effusum*, *D. hemisphaericum*, *Didymium squamulosum*, and *Physarum pusillum*.

SCOTT C. McCLARIN, STEVEN SHAFFER and PATRICK DROHAN, Institute for Environmental Science, Shepherd College, Shepherdstown, WV 25443.
Zion National Park Bighorn sheep (*Ovis canadensis*) habitat analysis.

Present locations of Bighorn sheep (*Ovis canadensis*) habitat in Zion National Park suggest that sheep populations are limited to the southeast of the park. However, why the sheep reside there is not clear. An analysis was conducted of sheep habitat and sheep visibility. Data included geology, vegetation, park transportation data, landforms and recreational areas. These data were used to develop a relationship between the requirements of the Bighorn sheep and the necessity for open space unique to range animals. It was found that sheep were located quite often within sight of major highways in the park. Annual bromes, the typical food source for Bighorn sheep, were not the dominant vegetation in the habitat area; pinyon pine (*Pinus edulis*) was the dominant vegetative species. Bighorn populations appear to be constrained to specific elevations that correspond to optimal foraging locations. Visibility of the Virgin River was a recurring factor in the location of Bighorn habitat across the landscape. Bighorn populations seemed to be migrating out of the primary park boundary.

MARY C. MCGINNIS and STEVEN L. STEPHENSON, Department of Biology, Fairmont State College, Fairmont, WV 26554.
Living and dead lianas as a special microhabitat for myxomycetes in tropical forests of Puerto Rico.

In Neotropical forests, myxomycetes (plasmodial slime molds) are now known to be associated with the surface of living and dead lianas, but no intensive investigation of this microhabitat has ever been carried out. In the present study, samples were collected from lianas at a number of study sites in Puerto Rico.

Most of the study sites (e.g., La Parguera, Barrio Coabey, and Barrio Bateyes) were located in the western half of the island. Forest types sampled ranged from coastal mangrove forests to subtropical wet forests. The samples of lianas were used to prepare a series of 55 moist chamber cultures. Values of pH obtained for these cultures were relatively high, ranging from 6.5 to 8.5 (mean = 7.5). Fifty-two of the 55 cultures have yielded some evidence (either plasmodia or fruiting bodies) of myxomycetes. Most of the species recorded thus far are members of the order Physarales, with the Trichiales (two species), Stemonitales (two species), and Liceales (only a single species) rather poorly represented. Members of the Physarales include *Diderma effusum*, *Didymium iridis*, *Physarum compressum*, *P. nicaraguense*, and *P. pusillum*.

JOANN SPOONER, MARIBETH OVERKING, and STEVEN L.

STEPHENSON, Department of Biology, Fairmont State College, Fairmont, WV 26554.
Myxomycetes associated with the microhabitats represented by ground litter, aerial litter, and dead lianas in the forests of Hawaii.

Samples of ground litter, several types of aerial litter, and dead lianas were collected at several localities along the northern coast of the island of Maui in Hawaii. These samples were brought back to Fairmont State College and used to prepare a series of 70 moist chamber cultures of the type used for isolating myxomycetes (plasmodial slime molds). Although the myxomycetes of Hawaii are relatively well known, the microhabitats considered in the present study have not been investigated previously. Our primary objective was to determine whether these microhabitats support assemblages of species similar in composition to those of comparable microhabitats in the Neotropics. For the most part, values of pH obtained for moist chamber cultures were relatively high (pH > 6.5), with the highest mean

value (7.6) recorded for dead lianas and the lowest mean value (6.2) for ground litter. Myxomycetes recorded thus far include two species (*Ceratiomyxa fruticulosa* and *Hemitrichia serpula*) usually associated with coarse woody debris and one example (*Cribraria confusa*) almost invariably associated with the bark of living trees. However, most other species (e.g., *Didymium iridis*, *Perichaena vermicularis*, *Physarum compressum*, and *Physarum pusillum*) are among those that might have been expected, based on data from studies carried out in Neotropical forests.

STEVEN L. STEPHENSON, Department of Biology, Fairmont State College, Fairmont, WV 26554, **HAROLD S. ADAMS**, Division of Arts and Sciences, Dabney S. Lancaster Community College, Clifton Forge, VA 24422, **CYNTHIA D. HUEBNER** and **GARY W. MILLER**, USDA Forest Service, Morgantown, WV 26505.
Short-term dynamics of forest communities on the Fernow Experimental Forest in Tucker County, West Virginia.

During June of 2000, quantitative data on the composition and structure of all strata of vegetation were collected from sixty 0.1 ha permanent study plots that had been established during the 1994 field season for the purpose of assessing short-term dynamics in relatively undisturbed forest communities on the Fernow Experimental Forest in Tucker County, West Virginia. Data for trees (stems > 10 cm DBH), small trees (stems > 2.5 cm but < 10 cm DBH), and saplings (stems < 2.5 cm but > 1.0 m tall) were obtained from the entire 0.1 ha study plot, shrubs were sampled in four 5 m by 5 m subplots, whereas seedlings and herbaceous plants were tallied in ten 1 by 1 m subplots. Except for striped maple (*Acer pensylvanicum*), which was recorded for the tree stratum in 2000 but not in 1994, overall species composition of the tree stratum remained the same for the two time periods. However, changes were noted in the relative importance of particular species of trees. For example, based on importance value

indices calculated from pooled data from all 60 plots sugar maple (*A. saccharum*), red maple (*A. rubrum*), beech (*Fagus grandifolia*), and black birch (*Betula lenta*) decreased in importance over the six-year period, whereas white oak (*Quercus alba*), tulip-poplar (*Liriodendron tulipifera*), and chestnut oak (*Q. prinus*) increased in importance. As would have been anticipated, the changes that occurred in the tree stratum were less noticeable than those recorded for some of the other strata.

comprised largely of sugar maple (*Acer saccharum*), chestnut oak (*Quercus prinus*), northern red oak (*Q. rubra*), American basswood (*Tilia americana*) and white ash (*Fraxinus americana*). Other cover types in the 1 km-radius circle were planted white pine (*Pinus strobus*) (1.3%) and open areas (2.2%).

CRAIG W. STIHLER, WV Division of Natural Resources, Elkins, WV 26241. **The evening bat (*Nycticeius humeralis*) in West Virginia: range extension and evidence of reproduction.**

The capture of a lactating evening bat during a WV Division of Natural Resources bat survey on Lewis Wetzel Wildlife Management Area, Wetzel County, WV represents the first documented evidence of reproduction of this species in the state. In the past, other than portions of the Eastern Panhandle, West Virginia has been considered outside the range of this species. Three other records were found for *N. humeralis* in West Virginia. Two date from the 1940's (Jefferson and Mercer counties). One was a male and the second a female; reproductive condition was not noted. Edwards et al. reported capturing an adult female near Riverton, Pendleton County in June 1998; reproductive status was not reported. In addition, Fowler reported finding an evening bat in Whittings Neck Cave, Berkeley County, in 1941; however, this specimen was determined to have been misidentified. The Wetzel County specimen was captured at 20:50 hr in a mist net set over Meathouse Run of Buffalo Run on 9 Aug 2000. The bat was flying approximately 0.6 m above the stream in an area of deciduous forest. The predominate land cover type in a 1-km radius circle centered on the capture site was deciduous forest (96.5%). These forests were

