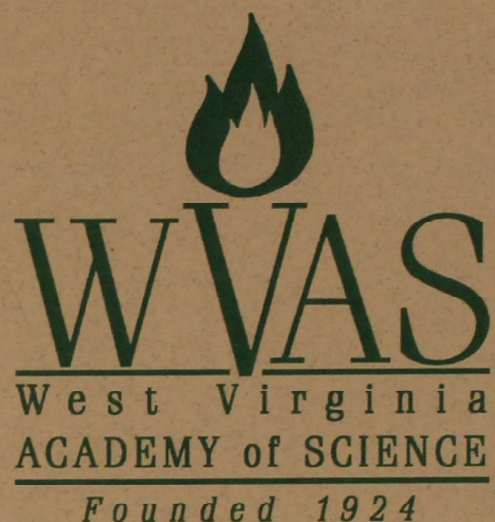


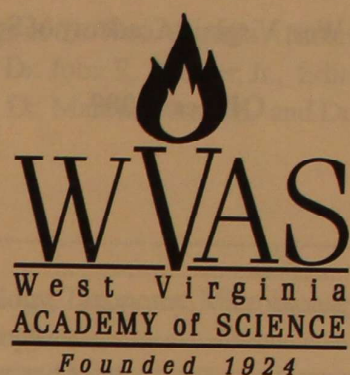
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For the Eighty-Fourth
Annual Session**



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Submitted Papers
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ORAL PRESENTATIONS

BIOLOGY

DUSTIN M. SMITH, STUART A. WELSH, and PHILLIP J. TURK, Cooperative Fish and Wildlife Research Unit, West Virginia University. **Relationship between Habitat Selection and Susceptibility to Predation in Larval Lampreys**

Refuge habitats are important for stream fishes. For habitat specialists, the loss of refuge habitats can impact populations in several ways, including a decrease in predator avoidance and survival rates. In a previous study, we found evidence that larvae (ammocoetes) of the least brook lamprey (*Lampetra aepyptera*) are not habitat generalists based on their significant selection of fine sand as habitat. In addition, ammocoetes neither selected nor avoided coarse sand and avoided clay/silt. Given that ammocoetes of the least brook lamprey are habitat specialists, we conducted another experiment to examine the relationship between available habitat types and susceptibility to predation (i.e., survival rates) of ammocoetes. In short, the experiment involved placing ammocoetes in different aquaria containing one of three substrates (fine sand, coarse sand, or clay/silt). Each aquarium also contained two individuals of a predator species (yellow bullhead, *Ameiurus natalis*). The survival rate of ammocoetes was highest in aquaria with fine sand (mean = 80%). In contrast, survival rates were lower in aquaria with coarse sand (mean = 58%) and clay/silt (mean = 4%). Based on the low survival of ammocoetes in clay/silt, it is possible that in streams highly-impacted by clay/silt sedimentation ammocoetes may have higher vulnerability to predation and lower survival.

ZACHARY J. LOUGHMAN¹, NICOLE GARRISON¹, MATHEW MCKINNEY¹, and STUART A. WELSH², ¹Department of Natural Sciences and Mathematics, West Liberty State College, ²USGS Fish and Wildlife Cooperative Unit, Morgantown. **Crayfishes of the Cheat River System: Temporal Changes, Natural History, and Conservation**

Intensive, basin-level crayfish surveys are historically lacking from West Virginia. The Cheat

River system is an exception to this, receiving attention by Hay in the late 1800's and an intensive effort by Schwartz and Meredith in the summer of 1956. The result of these endeavors is the opportunity to examine temporal shifts in crayfish distributions and abundance within a West Virginia River system. During the summer of 2008 the Cheat River system was surveyed. Survey sites were either randomly generated via GIS or historic sites visited both by Hay and by Schwartz and Meredith were chosen. Schwartz and Meredith (1960 and 1962) documented *Cambarus b. bartonii*, *Cambarus carinirostris*, and *Orconectes obscurus* occurring within the Cheat River system, questioning the taxonomic validity of *C. carinirostris*. Our efforts documented *Cambarus carinirostris* and *Orconectes obscurus* occurring within the basin and a complete lack of *C. b. bartonii* within the Cheat system. Two burrowing species were documented with our survey: *Cambarus dubius* and *Cambarus monogalensis*. Schwartz and Meredith's data indicated depauperate populations of *Cambarus* throughout the basin, as well as limited occupation by *O. obscurus*. Our survey efforts indicated that *C. carinirostris* is abundant throughout the Cheat River system except in areas impacted by acid mine drainage and extreme land use practices. Schwartz and Meredith (1962) predicted the extirpation of *O. obscurus* from the basin, given the polluted nature of the basin in 1956. *Orconectes obscurus* populations in 2008 appear stable in stream systems meeting the species ecological tolerances, but are not robust.

THOMAS K. PAULEY, Department of Biology, Marshall University. **Status of the Federally Threatened Cheat Mountain Salamander, *Plethodon nettingi* (Amphibia: Caudata): Sixty years later**

In 1948, Maurice Brooks described the habitat, seasonal and daily activities, reproduction, and sympatric species of the Cheat Mountain salamander (*Plethodon nettingi*) at four localities. In 1976, I began studying this species and during the ensuing 32 years have examined over 1300 sites. In this report, I compare my data for these four topics with data presented by Brooks 60 years ago.

DAN A. CINCOTTA¹, STUART A. WELSH², DAVID W. THORNE¹, and AARON R. YEAGER¹,
¹Division of Natural Resources, Elkins, ²U.S. Geological Survey, WVU Fish and Wildlife Cooperative Research Unit, Morgantown. **The Rediscovery of *Notropis scabriceps* (New River Shiner) in the Gauley River of West Virginia, with an Update of its Status Statewide**

Notropis scabriceps (New River shiner) was described by E. D. Cope in 1868 from tributaries of the New River in Virginia. It is endemic to these waters, which are a portion of the upper Kanawha River drainage (i.e., above Kanawha Falls) of the Ohio River system. This shiner is widespread throughout the upper Kanawha River, where it is found at times to be fairly abundant in streams and rivers of the Blue Ridge Province of Virginia and North Carolina, but sporadic and much less frequently encountered in watersheds of the Ridge-and-Valley and Appalachian Plateau of West Virginia. In West Virginia, it is known primarily from small streams and mid-size waters of the Greenbrier and Gauley rivers. Historically, it was fairly common to both watersheds, but has been documented less often in recent years, particularly from Gauley River drainages. In fact, until 2008 the New River shiner had been collected in the Gauley River only twice in sixty years. Recent collections in the Gauley River indicate that it may be extirpated from the lower and upper drainage areas, but still retains a viable population in the middle reaches. This talk will discuss the rediscovery of the New River shiner in the Gauley River, present possible reasons for its long-term absence and/or range reduction in the watershed, and review its status in West Virginia.

STUART A. WELSH and DAN A. CINCOTTA, Forestry, West Virginia University. **Occurrence of the Western Sand Darter (*Ammocrypta clara*) in an Eastern River: Biogeographic Implications**

Ammocrypta clara (western sand darter) occurs primarily in western portions of the Mississippi River system, but also includes records from a Lake Michigan drainage and a few eastern Texas Gulf Slope rivers. Additional range records depict a semi-disjunct distribution within the Ohio River drainage, including collections from Wabash River in Indiana, the Cumberland, Green, Kentucky, and Big Sandy rivers of Kentucky, and the upper Tennessee River in

Tennessee and Virginia. This study documents *A. clara* from the upper Ohio River drainage within the lower Elk River (Kanawha System), West Virginia, based on collections from 1986, 1991, 1995, 2005, and 2006. The Elk River population, consistent with those of other Ohio River drainages, has slightly higher counts for numbers of dorsal-fin rays, scales below lateral line, and lateral line scales when compared to data from populations outside of the Ohio River drainage. Modal counts of meristic characters are similar among populations, except for higher modal counts of lateral line scales in the Ohio River population. The discovery of the Elk River population extends the range distribution of *A. clara* to the Eastern Highlands region, and documents wide distributional overlap and additional sympatry with its sister species, *Ammocrypta pellucida* (eastern sand darter).

CHRISTOPHER VOPAL¹, NICOLE GARRISON¹, MATHEW MCKINNEY¹, STUART A. WELSH², and ZACHARY J. LOUGHMAN¹, ¹Natural Sciences and Mathematics, West Liberty State College, ²USGS Fish and Wildlife Cooperative Unit, Morgantown. **Crayfishes of the West Virginia Portion of the James River System with an Emphasis on the Conservation of *Cambarus longulus***

West Virginia's crayfishes have received more concerted conservation efforts in the past five years than the previous two decades. Primary to this effort has been the documentation of current distribution and conservation status of the state's 20+ crayfish species. Surveys of under-sampled river basins have occurred in recent years, resulting in several new county records and an updated understanding of West Virginia's crayfish fauna. One such basin within West Virginia is the small portion of the James River, in Monroe County. *Cambarus longulus*' entire range in West Virginia occurs within the confines of the James. Loughman et al. (in press) recently noted the disparate, disjunct nature of *C. longulus* populations in the James and the need for a conservation assessment of this species. In response to this, we performed a detailed survey of the James River crayfish fauna. Twenty five survey sites included randomly generated stream reaches, as well as historic *C. longulus* localities. At each site both physiochemical and biotic data were collected, and 10 seine hauls were performed to generate CPUE

values. Results indicate that *C. longulus* is stable in the James River system, specializing in moderate stream orders and fulfilling the niche of a tertiary burrower. Other crayfishes collected within the James Basin included *Cambarus b. bartonii* and *Orconectes cristavarius*. *Cambarus dubius* was the only burrowing species encountered within the system.

J. CURTIS and P. VILA, Department of Environmental Studies, Shepherd University. Herpetological Survey of the Eastern Panhandle of West Virginia

A preliminary qualitative herpetological survey of the Eastern Panhandle was conducted from Spring 2005 to late Summer 2005. The survey objective was to provide basic information about the current distribution of native reptiles and amphibians. Sampling was opportunistic and habitats were grouped into (1) on or next to roads, and (2) other habitats including riparian areas, mature deciduous forest, ephemeral pools, and edge habitats such as railroads. Samples were identified by examination of reptile and amphibian road mortality, observations of live animals in the field, and audible calls. Fifty-nine locations contained herpetofauna; 12 species of reptiles and 7 species of amphibians were identified. All species identified are native to the region and none are listed as threatened/endangered or considered rare. Approximately 26 species of amphibians and 35 reptiles are expected in the Eastern Panhandle. The depauperate fauna found in this initial survey raises concerns about the effects of agricultural and development pressure on habitat used by the herpetofauna. A more detailed population assessment is essential to assess and monitor the herpetological diversity in the Eastern Panhandle.

ROGER SEEGER, JR., JESSICA WEST, and CHRIS NEIDHARDT, Dept. of Natural Sciences, West Liberty State College, West Liberty, WV 26074. The Reorganization of the West Liberty Tomato Genetics Preservation Project

For over ten years this project has attempted to collect and preserve regional and commercially known varieties of tomato (*Lycopersicon esculentum*). Recently the need for a reorganization and development of a naming system more acceptable and suitable for

a genomic seed collection became evident. The collection currently contains 791 open-pollinated tomato seed samples and have been kept in both dry storage and frozen at -4°C. The current system is a simple numbering of the vials in which they are stored and is not the standard system. Work in conjunction with Dr. Larry Robertson, Vegetable Crops Curator of the USDA, ARS Plant Genetic Resources Unit in Geneva NY, and Dr. Barbara Liedl of WV State College has allowed the development of a more appropriate seed classification and collection nomenclature. This will be presented and a general update on the condition and goals of the collection will be reviewed.

FAITH N. HARPER, GARY MORRIS, LISA CASTLE, and JAKE MCDUGAL, Department of Science and Mathematics, Glenville State College. Genetically Identifying *Ailanthus altissima* Variants

Ailanthus altissima, commonly known as the tree-of-heaven (TOH), is an invasive species native to China that was introduced to North America for horticulture and urban forestry in the 1700's. The TOH is hard to remove from areas where it persists; it is therefore of interest to track the spread pattern of this invasive species throughout West Virginia. To this end we are applying a method that will allow us to genetically identify variants found in West Virginia by analyzing samples that have been collected by volunteers statewide. The method uses the polymerase chain reaction to determine the presence and length of nucleotide sequences that correspond to loci found in nine alleles of different *Ailanthus altissima* variants. Primers are being used to identify the following alleles: Aa22 (171-211 bp), Aa68 (206-233 bp), Aa69 (152-214 bp), Aa75 (93-138 bp), Aa76 (141-194 bp), Aa79 (122-172 bp), Aa80 (167-225 bp), Aa82 (109-170 bp), and Aa92 (157-195 bp). It is our hypothesis that by identifying these alleles it will be possible to trace the spread of TOH across the state. Trees that are geographically closer to each other are expected to have more similarities in the sequence and length at each allele than those trees that are geographically more distant from one another. Our approach follows a simple student-friendly protocol for acquiring the genetic material of TOH, allowing our volunteers to include high school students and teachers.

MARY R. GRIFFIN, ADAM WALKER, ASHLEY MILLS, CALVIN MUNDY, and PHIL CLEM, Biology Department, University of Charleston. ***Beauveria bassiana*: Cucurbits, Carrots, and Carnivorous Plants**

Beauveria bassiana an entomopathogen has demonstrated what has been described as "kingdom-hopping" due to its ability to colonize a variety of cultivated plants. *Beauveria bassiana*'s colonization of cotton tissue and biocontrol capability against seedling disease were greatly enhanced following re-isolation from surface-sterilized cotton tissues (Griffin et al. 2005, Griffin 2007 and Ownley et al. 2008). In this study initial introduction of *B. bassiana* to plant-host media and subsequent conidial growth varied based on the isolate's utilization of different plant nutrients. *Beauveria bassiana* isolate GHA exhibited copious conidial sporulation following inoculation of one mL of 3-day old mycelia in liquid broth onto carrot and pumpkin agar plates. Seeds from carrot and squash varieties were coated with *B. bassiana* conidial spores using a methylcellulose sticker. Conidial sporulation on Venus fly trap (*Dionaea muscipula* Sol ex Ellis) agar was sparse and on Sundew (*Drosera* L.) limited. *Beauveria bassiana* was dusted onto fruit flies (*Drosophila melanogaster* Meigen) and fed to both species. An assay to determine if *B. bassiana* isolate GHA lost virulence following growth on host-based media was conducted using fruit flies. Evidence for *B. bassiana* exhibiting enhanced colonization of a variety of plants can be expected following re-isolation from surface-sterilized plant material or growth upon host-based media.

K. T. TREVEY¹, P. VILA¹, J. ARNER², C. PLAUTZ², and D. DILELLA³, Department of ¹Environmental Studies, ²Biology, ³Chemistry, Shepherd University. **Assessment of *Escherichia coli* and Chemical Data in the Surface Waters of Jefferson County, West Virginia**

Ten streams in the Potomac and Shenandoah drainages of Jefferson County, West Virginia were sampled for levels of *Escherichia coli* from May 2006 to February 2009. Three hundred sixty-four of the 426 samples were mainstem stream samples and 62 were from feeder springs. Forty-eight percent of all mainstem stream samples and up to 92% of mainstem

samples from within a single stream exceeded the EPA criterion of 400 CFU/100 mL for lightly used waters with full body contact. Samples from two dates in 2008 and 2009 were analyzed for SO_4^{2-} , NO_3^{-1} and Cl^{-1} by ion chromatography. Chloride ion concentrations ranged from 5 to 70 mg/L and SO_4^{2-} ranged from 5 to 34 mg/L; NO_3^{-1} ranged from 6 to 46 mg/L, with the highest values found in spring samples. Physical data for temperature, turbidity, pH, dissolved oxygen, redox values, specific conductivity, and salinity were within the normal range of expected values. Jefferson County streams are heavily polluted with bacteria and nutrients, suggesting a significant level of human impact. While 48% of mainstem stream samples had bacterial levels above the EPA criterion, only 3% of feeder spring samples exceeded the EPA criterion. This suggests that bacterial contamination of mainstem stream water is due to shallow subsurface and overland flow, and not due to groundwater. However, nitrate levels are higher in feeder spring samples than in mainstem stream samples, suggesting that groundwater may be a more important contributor to mainstem nutrient levels than surface or shallow subsurface waters. This has implications for the mitigation of surface water nutrient contributions to the Chesapeake Bay.

CLIFFORD E. STARLIPER¹ and BARNABY J. WATTEN², ¹National Fish Health Research Laboratory and ²Restoration Technologies Laboratory, US Geological Survey, Leetown Science Center. **Novel Method to Decontaminate Ship Ballast Water: Testing on Pathogenic and Environmental Bacteria**

Ship ballast (water) is a well-recognized conveyer of nonindigenous aquatic species to the US. A high-profile example of this is the zebra mussel *Dreissena polymorpha*, a mollusk introduced to the Great Lakes in the 1980's. Zebra mussel introduction has led to extirpations of native populations, altered ecosystems, and huge financial losses. The International Maritime Organization recently developed international legislation (D2 Standards) specifying the maximum numbers of indicator microorganisms that may be released via ballast water (Lloyd's Register, 2007). Ships constructed during and after 2009 must decontaminate ballast and conform with the new D2

Standards. Three (of five; the other two are plankton) indicator microorganisms are bacteria; *Vibrio cholera* (< 100 cfu/100mL), *Escherichia coli* (< 250 cfu/100mL), and intestinal (i.e. mammalian source) enterococci (< 100 cfu/100mL). We are exploring the feasibility of using hydrated lime (for increased pH) for use as a ballast decontaminant. Our current study focuses on its bactericidal efficacy to a variety of Gram-negative and Gram-positive bacteria, including potential human pathogenic coliforms, environmental pollution indicators including those addressed in the D2 Standards, and fish pathogens common in aquatic ecosystems that are transmitted via water. We developed controlled, in vitro studies to determine endpoint treatment parameters necessary to achieve our target of 100% bactericidal activity. Replicate cultures were evaluated at pH 10-12 and for up to 72h. Although the pH and duration endpoints varied, we demonstrated 100% killing to all bacterial species tested thus far. Future studies will involve on-board-ship testing and delivery and mixing process applications.

M. AARON MILLER, Department of Computer Science, Mathematics, and Engineering, Shepherd University. **Measuring Muscle Voltage**

This project aims to quantify the electrical signal sent through muscles when they contract. Voltage is measured at both ends of the bicep muscle as the arm lifts various amounts of weight. The goal is to note any differences in the signal at the various strain levels. This information can then be used to better understand how muscles are controlled by electricity and how it may be possible to control muscles if the body can no longer send its own signal.

Engineering

ERIC FIZER¹, DONALD D. GRAY², and KENNETH J. SEMMENS³, ¹Graduate Research Assistant, Department of Mechanical and Aerospace Engineering, ²Professor, Department of Civil and Environmental Engineering, ³Extension Specialist, Aquaculture, West Virginia University. **Characteristics of Turbulence in the Quiescent Zone of an Aquaculture Raceway**

An aquaculture raceway is a water-carrying open channel of rectangular cross section used to raise fish. The main objective of this research is to measure the flow characteristics within a small section at the end of an aquaculture raceway called the quiescent zone. The flow through the raceway at Dogwood Lake, West Virginia, has a Reynolds number of approximately 2×10^4 , which indicates that the flow is mildly turbulent. An Acoustic Doppler Velocimeter (ADV) is used to measure velocities in three dimensions at a point. The velocities measured by the ADV are sampled at 10 Hz and averaged over a 360 second time interval in order to calculate a mean velocity and other statistical parameters in each direction. ADV measurements allow for flow characteristics such as mean velocity profiles, turbulence intensity profiles, and Reynolds stress profiles to be measured within the quiescent zone. These profiles seem to contain fully developed characteristics in certain regions, but vary dramatically from those of fully developed turbulence in others. The large eddy range, inertial subrange, and dissipation range are difficult to separate in several measurements of the energy spectrum. Discrepancies between these measurements and classical results are due to disturbances in the raceway that prevent the flow from becoming fully developed. *This work is supported by the Cooperative State Research Education and Extension Service, U.S. Department of Agriculture.*

EGEMEN OGRETIM^{1,2}, DONALD D. GRAY^{1,2}, and GRANT S. BROMHAL¹, ¹National Energy Technology Laboratory, ²Department of Civil and Environmental Engineering, West Virginia University. **Response Time of Vadose Zone Gas Currents to Changes in the Wind**

Coal is a major energy resource for the United States and the world. The increasing accumulation of carbon dioxide in the atmosphere from the combustion of coal must be reduced in order to moderate global warming. Carbon Capture and Storage (CCS) is an important element in the portfolio of mitigation plans. For the safe and effective execution of CCS, a continuous monitoring of the vadose zone and the Earth surface above sequestration sites is essential in order to detect potential leaks before any undesired effects occur. In this study, we consider the interaction of atmospheric winds over hill-like topographies. In

particular, we simulate the response time of the gas currents in the vadose zone to wind speed changes. The knowledge of the mentioned time will enable us to better judge the size of the time steps needed in long term computer simulations. *This project is supported by the National Energy Technology Laboratory, U.S. Department of Energy. The conclusions are those of the authors.*

GUOXIANG (GAVIN) LIU¹, DONALD D. GRAY^{2,3}, and GRANT S. BROMHAL³, ¹Graduate Research Assistant, Department of Civil and Environmental Engineering, West Virginia University, ²Professor, Department of Civil and Environmental Engineering, West Virginia University, ³National Energy Technology Laboratory. **Scheme to Enhance Near-Surface Carbon Dioxide Monitoring Using Barometric Pumping**

The integrity of carbon dioxide sequestration in geologic formations must be demonstrated by near-surface monitoring. In many leakage scenarios, carbon dioxide escapes at low concentrations over wide areas. This presentation explores a method to concentrate the leakage from a large area so that the number of detectors and their required sensitivity can be reduced. This scheme is an adaptation of a technique for the passive removal of volatile organic contaminant spills proposed by SEAI (1996). Natural variations in atmospheric pressure on a daily to weekly time scale cause air to flow into the ground as the atmospheric pressure rises and to flow out of the ground when the atmospheric pressure falls. In order to make use of this atmospheric pumping phenomenon, some tens of square meters of ground surface is covered by an impermeable membrane. At the center of the covered area is a one way vent valve that opens when the flow is out of the ground. The result is that the outflow from a large volume of soil is concentrated at the vent. In the proposed application, a carbon dioxide sensor would be placed at the vent. COMSOL has been used to perform numerical simulations of this scheme. The numerical model was verified by comparison of the velocity and pressure fields predicted by the numerical and analytical solutions.

Simulation results indicate that the permeability, porosity, and the variation of atmospheric pressure affect both the near-surface leakage flux and the flux distribution with depth. As expected, larger pressure

variations create larger vent flowrates for the same geological properties. The subsurface flow enhancement decreases with depth. *This research is supported by the National Energy Technology Laboratory, W.S. Department of Energy. The conclusions are those of the authors.*

Reference: Science and Engineering Associates, Inc. (SEAI), 1996. *Barometric Pumping with a Twist: VOC Containment and Remediation without Boreholes, Phase I*. Technical Report, Science and Engineering Associates, Santa Fe, NM.

PAUL J. KREITZER and JOHN M. KUHLMAN, Department of Mechanical and Aerospace Engineering, West Virginia University. **Monte-Carlo Simulation of Impinging Liquid Spray Droplets**

Spray-cooling is a promising technique for future applications in aircraft, spacecraft, and computers that has demonstrated heat fluxes above 1000 W/cm². Computational fluid dynamics simulations of sprays are limited to single droplet studies; these take several days to converge. Therefore, more efficient models are needed to predict onset of critical heat flux. Using a Monte-Carlo computer simulation along with established time scale analyses, a model is being developed to help predict the onset of critical heat flux.

Current efforts have developed a computer simulation using a random number generator to model impingement of spray droplets onto a heated surface, controlling physical properties and location of each droplet based on input conditions. Using time scale estimates, criteria have been established for each crater formed from an impinging liquid droplet. Color-coded figures are generated to display each droplet impact and phenomena occurring at that location versus time. Colors have been applied to each crater representing: (1) a droplet impact onto the liquid film on the heater surface to form an impact crater, (2) the onset of boiling of the thin film in the crater, (3) dryout of the thin film, and (4) covering of a crater by a subsequent droplet impact.

Plotting percentages of the heater surface covered by each crater type will allow individuals to determine what portion of the heater surface is undergoing each phase of droplet behavior. Future efforts will compare simulation results with experimental results for validation. *Support from the West Virginia NASA Space Grant Consortium is appreciated.*

DONALD D. GRAY^{1,2}, EGEMEN O. OGRETIM^{1,2}, and GRANT S. BROMHAL², ¹Department of Civil and Environmental Engineering, West Virginia University, ²National Energy Technology Laboratory, U.S. Department of Energy. **Flow Over a Wavy Surface**

The deep underground injection of carbon dioxide produced in fossil fuel power plants is one promising strategy for reducing global warming. To assure that this technology is safe and effective, geologic sequestration sites must be monitored to detect any leaks of carbon dioxide back to the atmosphere. The optimal deployment of monitoring sensors requires an understanding of the factors affecting the motion of carbon dioxide gas in the unsaturated (vadose) zone near the Earth's surface. One factor that must be studied is the effect of the pressure distribution produced by the wind at the ground surface. This paper presents an analytical solution for a steady two dimensional planar flow of incompressible, inviscid fluid over a periodic wavy surface. This flow simulates wind blowing across a series of parallel hills and valleys. The velocity field and the resulting pressure distribution on the ground surface are presented in the form of equations and graphs. *This research is supported by the National Energy Technology Laboratory, U.S. Department of Energy. The conclusions are those of the authors.*

DEEPAK MEHRA¹, DONALD D. GRAY², JOHN M. KUHLMAN³, and KIRK L. YERKES⁴, ¹Division of Mathematical and Physical Sciences, Potomac State College of West Virginia University, ²Department of Civil and Environmental Engineering, West Virginia University, ³Department of Mechanical and Aerospace Engineering, West Virginia University, ⁴U. S. Air Force Research Laboratory, Wright-Patterson Air Force Base. **Effects of Different Body Forces on an Impinging Liquid Jet**

The electric Kelvin force is a body force that can act to enhance or minimize gravity if oriented properly. In this research an electrode arrangement was designed to obtain a nearly uniform electric Kelvin force so as to simulate the effect of variable gravity on a liquid jet or spray impinging on a heated surface. The electrode system was built and tested by Glaspell

(2006) who reported a 5.2 % increase in heat transfer coefficient in her spray-cooling apparatus when a voltage of 23 kV was applied. Computational results are presented herein of an isothermal jet impinging normally on a plane surface under the influence of the electric Kelvin force produced by this electrode system and gravity. The simulations were performed using CFD-ACE+, a commercial computational fluid dynamics code developed for multi physics simulations. The simulations show that the flow accelerates in the presence of gravity only, and at low Reynolds number this increase can be seen in the contraction of the jet not seen in the absence of gravity. Also, with the electric Kelvin force opposing the flow, a slight difference in the axial velocity was observed in the region close to the impingement surface. The effect of the electrode was more significant on heat transfer in a spray-cooling apparatus, causing a 5.2 % increase in heat transfer coefficient. *Sponsored by the Air Force Office of Scientific Research under grant number F49620-03-1-0276. The views and conclusions contained herein are those of the authors and not necessarily those of the sponsor.*

Reference: Glaspell, S., 2006. *Effects of the Electric Kelvin Force on Spray Cooling Performance*, MS thesis, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV.

Physics

C. SHANE POLETTI and MARTINA E. BACHLECHNER, Department of Computer Science, Math, and Physics, Fairmont State University. **Determining the Depth of Amorphization of Crystalline Silicon due to Hypervelocity Impact**

Silicon solar cells power satellites that are used for many aspects of modern life. Debris in space can impact the solar cells, changing their mechanical properties. Classical atomistic computer simulations have been developed to simulate impacts on a silicon/silicon nitride interface. Visualization indicates that the crystalline silicon amorphizes upon impact. The objective of the present study is to determine where the boundary between amorphous and crystalline silicon occurs. Based on three different simulations with

impactor speeds of 5 km/s, we have studied the influence of the silicon target thickness on the depth of amorphization.

Funding for this research project was provided by a WV/NASA Space Grant Scholarship.

Science Education

NORMAN C. CLAMPITT and RHONDA KRATOCHVIL, Department of Natural Science and Mathematics, West Liberty State College. **A Circuit for Using a Thermistor as a High-Resolution Differential Temperature Probe**

Use of commercial temperature probes interfaced to desktop computers using hardware and software available from the supplier has automated the acquisition of temperature data as a function of time. This is very useful in the saving of time required for the data acquisition as well as in reducing errors in reading and accurately recording the observed data. However, one limitation inherent in all currently available, commercial data-acquisition systems is the number of significant figures with which the temperature can be obtained over a very narrow range of temperature on the order of two to three degrees. Yet, a number of experiments often done in undergraduate Physical Chemistry laboratories result in a change of temperature over just such a range.

Our laboratory has developed a thermistor circuit that can be adjusted to start readings at any temperature near room temperature and read a range of temperatures extending over two to four degrees while using the voltage probe and the interfacing hardware and software of a commercial system to measure voltages from near zero volts at one end of the temperature range to a maximum of +10 volts at the other end of the range. Since the resolution of the voltage probe is frequently 0.005 volts, this gives three significant figures resolution to the temperature measurement when the full 10-volt range of the voltage probe is utilized. This is at least one significant figure more than most commercial temperature-measuring systems offer.

Computer Science

RON REASER and PAUL DAY, Computer Science and Electrical Engineering, College of Engineering and

Mineral Resources, West Virginia University. Simulating BFS for SSSPP Using Random Selection

Our work was to test an implementation of the Random-BFS algorithm by Subramani and Madduri [1]. The algorithm approximates the behavior of Breadth-First Search (BFS) using randomized selection instead of a queue to process the nodes for single source shortest path problems (SSSPP). We modified it to use mixed edge weights instead of uniform edge weights as in the original study. We tested the behavior of the new Random-BFS compared to Dijkstra for sparse and dense random graphs, mesh graphs, and scale-free graphs with varying ratios of small and large edge weights.

Results show that the new algorithm performs well, like the original, but that the running time is highly dependent on the spread of the edge weights. The algorithm is promising for use in distributed computing because a queue need not be maintained, allowing the shortest path to be found across multiple processors by randomly approximating first-come, first-serve behavior. Because running times are comparable to Dijkstra, the distributed computing benefit can be realized without drastic performance loss.

[1] *A Randomized Queueless Algorithm for Breadth-First Search*, IJCA, Vol. 15, No. 3, Sept. 2008.

MATT WILLIAMSON, Lane Department of Computer Science and Electrical Engineering, West Virginia University. **A Faster Algorithm for the Single Source Shortest Path Problem with Few Distinct Positive Lengths**

In this presentation, we propose an efficient method for implementing Dijkstra's algorithm for the Single Source Shortest Path Problem (SSSPP) in a graph with positively lengthed edges, and where there are few distinct lengths. The SSSPP is one of the most widely studied problems in theoretical computer science and operations research. On a graph with n vertices, m edges, and K distinct edge lengths, our algorithm runs in $O(m)$ time if $nK \leq 2m$ and $O(m \log(nK)/m)$ time otherwise. We tested our algorithm against some of the fastest algorithms for SSSPP on arbitrarily (but positively) lengthed graphs.

Our experiments on graphs with few edge lengths confirmed our theoretical results, as the proposed algorithm consistently dominated the other SSSPP algorithms that did not exploit the special structure of having few distinct edge lengths.

JEFF WALKER, Business (Computer Information Systems) Department, Glenville State College. **Parent-biased Selection in Genetic Algorithms**

Given an adequate supply of building blocks, genetic algorithms work by growing the numbers of superior building blocks. Noise and deception can make this growth difficult for simple genetic algorithms, leading to convergence to a local optimum rather than a global optimum. A similar problem can occur in nature. Animal husbandry and horticulture attack this problem in part by basing selection for mating on a combination of offspring and ancestor fitness. In this study, an alternative genetic algorithm selection scheme, based on a blend of ancestor and offspring fitness, is developed to assist with the growth of the appropriate building blocks in noisy and deceptive problems. Results of the study suggest that under certain conditions, this parent-biased selection can assist with the exploration phase of genetic algorithms.

MAHMOOD HOSSAIN, Department of Computer Science, Math, and Physics, Fairmont State University. **Improving the Performance of the A* Algorithm**

A* is one of the most popular heuristic search algorithms. However, its memory requirement is huge since all nodes generated by the algorithm are required to be stored prior to termination. The number of nodes generated has been shown to be exponential with the length of the solution path. Moreover, as the size of the problem instance increases, the computational overhead for the selection of the next node to be expanded by A* becomes significant. This work presents a modified version of A* that can return optimal solutions with significantly lower memory requirement and computational overhead than A*. The proposed method executes in several iterations. It performs a best-first strategy in each iteration, pruning a node whenever its cost estimate exceeds a given threshold value. It keeps track of nodes that are

completely expanded and these nodes are not needed to be expanded again. The proposed method along with A* was implemented using the 8-puzzle problem. Experimental results show that the proposed method always returns the optimal solution with a consistent heuristic function and outperforms A* in terms of space and computational time.

Mathematics

JUSTIN NEIL, **NATALIE WHITE**, and **PAUL PECK**, Department of Mathematics, Glenville State College. **Rings of Prime Power Order**

A ring is an algebraic structure with the binary operations of addition and multiplication, and the properties of additive identity, additive inverse, additive commutativity, associativity, and distributivity of multiplication over addition. The additive operation on a ring produces an Abelian group.

The purpose of this research was to develop a computer application to generate representations of all possible rings of a given order and construct multiplication tables for each. This project was derived from a paper written by Michael Lin entitled "Rings of Small Order." Along with his findings, he developed a computer program written in IBM PC assembly language that produced multiplication tables for each ring, the total number of rings generated, and the first $n-1$ powers of each element for each ring. We developed a computer program that allows us to investigate larger finite rings and explore other properties such as isomorphism and automorphism.

KRISTEL CHASE, **QING WANG**, and **ZHIJUN WANG**, Department of Computer Science, Mathematics and Engineering, Shepherd University. **Analysis on SARS Models**

This project is designed to show how to use differential equations to simulate the spread of the SARS disease. The SARS epidemic attacked Asia in 2003 leaving almost a thousand people dead and almost 2,000 sick. Before quarantine and isolation methods were put into place in late February of 2003, the disease spread quickly. However, once the quarantine and isolation methods, as well as more public awareness

and stricter health precautions, were put into place, the disease started to die out.

By dividing a population into six subpopulations, namely, susceptible (*S*), asymptotically infected (*E*), quarantined (*Q*), symptomatic (*I*), isolated (*J*), and recovered (*R*) individuals, the spread of SARS can be modeled into differential equations, using ratios and the probability of one subpopulation moving to the others. The solution to the obtained differential equations can then approach equilibrium, a steady constant solution (a disease-free status).

Analyzing the reproductive number then can lead to finding when the equilibrium is asymptotically stable or unstable. Thus, it can be determined when the disease can stop spreading and can be controlled.

The obtained result can also be used to study the spreading of other diseases to find their reproductive number and eventually get those diseases to be eliminated as well.

PAUL PECK and JUSTIN NEIL, Department of Science and Mathematics, Glenville State College.
Progress Report on Determining Finite Rings with Full Automorphism Group

Symmetries of mathematical and physical objects often provide deep insight into the fundamental properties of those objects. Thus, as we studied the generation of tables for finite rings by a computer program, it was natural to look at the group of automorphisms for the finite rings that were generated. Since a ring automorphism must preserve addition and multiplication, all such automorphisms must necessarily be automorphisms of R^+ , the group of the ring elements with operation the addition in the ring. Thus, the following natural problem occurs: Determine all finite rings R whose group of ring automorphisms is the same as the group of automorphisms for R^+ .

It is clear that any ring with all products equal to 0 will have this property. We found other examples. We were able to prove that twice any product must be 0 in such a ring. Thus, if the order of R is prime to 2, such rings will have all products equal to 0 and the problem is then reduced to finding all rings of order 2^n with the property.

When the characteristic of the ring is 2 we are able to show that there are two such rings when the order of the ring is also 2 and only rings with all

products equal to 0 when $n > 1$. When the characteristic is 2^m , $m > 2$, we have obtained some necessary conditions on the products of the generators. A summary of our work and progress toward a complete solution will be reported.

POSTER PRESENTATIONS

Biology

JESSICA M. LANTZ, NICK PAHOUNDIS, and MILAN C. VAVREK, Department of Land Resources, Glenville State College. **Effect of *Ailanthus altissima* on a Forest Macroinvertebrate Community**

Tree-of-heaven, *Ailanthus altissima*, a nonnative species, has invaded large areas of West Virginia. As a member of the Simaroubaceae, this species produces quassin in its bark and leaves. Ailanthone, one type of quassin, exhibits herbicidal and insecticidal properties. It is unknown whether the presence of *Ailanthus* has an effect on native soil macroinvertebrates. Impacts on macroinvertebrates are important because of their role in nutrient cycling and as a food source for fauna.

Pit traps were used to test whether differences occurred in the soil macroinvertebrate communities between hardwood forest patches with and without *Ailanthus* and whether the presence of leaf litter affected macroinvertebrate diversity and abundance. In each of the two patch types, litter was left on half of the plots and removed on the remainder. Samples were gathered weekly over four weeks ($n=16$) and analyzed to determine the effect of *Ailanthus* on macroinvertebrate composition, richness, and abundance. More individuals and orders were found in areas of *Ailanthus* cover than in native hardwoods. Four of the eighteen orders (Isopoda, Diplopoda, Coleoptera, and Gastropoda) collected exhibited significantly increased numbers in the presence of *Ailanthus*. There were no differences between sites for other abundant orders, such as Aranea, Opiliones, and Hymenoptera. Overall richness and abundance also increased in the presence of litter.

A change in competitive relationships and trophic structure of the soil macroinvertebrate community may have long-term consequences for the ecosystem. More research is needed to understand the effects of

Ailanthus and the implications of changes in the macroinvertebrate community.

JESSE DE LA CRUZ, TROY RADCLIFF, and RICO GAZAL, Department of Land Resources, Glenville State College. **Influence of Light Regime and Shade Tolerance on Leaf Structure of Native Species and *Ailanthus***

Understanding the invasive characteristics of *Ailanthus altissima* is crucial in controlling its spread and dominance in the native hardwood forest ecosystem. In this study, we examined leaf-structural and morphological differences among co-occurring native species (white ash, American elm, black cherry, and black walnut) and invasive *Ailanthus* and their tolerance to different light conditions in central West Virginia. In all species, sun leaves under open conditions had greater thickness and lower specific area than shaded leaves in the understory. Among the species examined, *Ailanthus* had the largest leaf area, which makes it more competitive in capturing light. Black walnut and *Ailanthus*, both shade intolerant and allelopathic, showed no differences in specific leaf area under forest edge and interior conditions. These two species also had lower stomatal density and shorter guard cell length in open than understory condition, which make them more efficient in leaf-gas exchange (i.e. photosynthesis, transpiration). On the other hand mid-tolerant species (American elm and black cherry) showed significant differences in specific leaf area, which suggests leaf acclimation under different light conditions. This study illustrates the potential of using leaf morphology and structure in characterizing the competitive ability of co-occurring native and invasive tree species that differ in shade tolerance.

KRISTA DUNCAN and LISA CASTLE, Department of Science and Mathematics, Glenville State College. **Effects of Acid Rain on Tree-of-Heaven (*Ailanthus altissima*) Growth vs. Red Maple (*Acer rubrum*) Growth**

The experiment was undertaken to determine whether or not acid rain has an effect on the growth and germination of tree-of-heaven, *Ailanthus altissima*, and red maple, *Acer rubrum*. Five hundred seeds of each species were scarified and then stratified

for 60 days. Once stratification was completed, the seeds were divided into two groups and planted. In order to determine effects of acid rain on established seedlings, one group was grown for six months before treatment. The other group was treated immediately with the acid solution to determine the effects on germination rates. In both cases treatment consisted of a mock acid rain solution of 6.44×10^{-4} M H_2SO_4 applied every other day. The acid solution had a significant inhibitory effect on the germination of both tree-of-heaven and red maple, with a much more pronounced effect on the red maple. The acid did not have a significant effect on growth of established tree-of-heaven seeds, while the effects on the red maple seedlings were inconclusive. This supports the hypothesis that the invasive nature of the tree-of-heaven could be due to its ability to survive in polluted areas, although further research into the mechanism is needed.

JASON D. POLING and LISA M. CASTLE, Department of Science and Mathematics, Glenville State College. **Phenology of the Tree-of-Heaven**

The tree-of-heaven (*Ailanthus altissima*) is an invasive species that can spread and grow extremely quickly. The tree-of-heaven is invading the territory of our native deciduous forest species. Many explanations for the species' success as an invader has been proposed, including allelopathy, tolerance of pollution and disturbance, and timing of life events that may impart a competitive advantage. These studies were undertaken to observe if tree-of-heaven does exhibit key phenological events (bud burst and leaf drop) at different times than surrounding native trees. Ten trees-of-heaven and three neighboring trees were each monitored during the spring and autumn. Bud characteristics were monitored in the spring and leaf color change and leaf drop monitored in the autumn. Tree-of-heaven buds appeared later in the spring than the buds of neighboring trees, while in the autumn the trees-of-heaven turned later and held their leaves significantly longer than surrounding trees did. These results partially support the hypothesis that phenological differences, specifically extending the active growing season in the fall, may account for some of the species' invasive tendencies.

ADAM WALKER, CALVIN MUNDAY, MARY R. GRIFFIN, and PHIL CLEM, Biology Department, University of Charleston. **Insects as Agents of Endophytic Colonization by *Beauveria bassiana* in Carnivorous Plants**

Beauveria bassiana, a commonly known entomopathogen, is capable of colonizing a variety of cultivated plants, such as corn, tomato, cotton, and soybean. This endophytic colonization of healthy plants has occurred following a variety of techniques including foliar spray, seed application, and root and rhizome dips. At this time however, it is currently unknown if infected insects are capable of transferring *B. bassiana* to a plant. *Beauveria bassiana* isolate GHA was grown upon two media prepared from ground Venus fly trap (*Dionaea muscipula* Sol ex Ellis) and Sundew (*Drosera* L.) plants. Conidial spores were harvested and introduced via a feeding application to healthy Venus fly trap and Sundew plants. Venus fly trap pods readily absorbed both fruit flies (*Drosophila melanogaster* Meigen) and *B. bassiana* conidial spores visibly present at inoculation. Positive and negative controls were also conducted. Using traditional plating techniques, surface-sterilized plant material was plated onto *B. bassiana*-selective media to determine the presence of endophytic activity approximately two weeks following feeding.

ADAM HAMRICK, SARAH BRIGHT, BRIANA CAMPBELL, BONNIE POLLOCK, MARK FLOOD, and SARAH DODSON, Department of Biology, Chemistry, & Geoscience, Fairmont State University. **Alteration of Upstream Stimulating Factor 1 Protein Expression in Cultured Endothelial Cells**

Upstream Stimulating Factor 1 (USF1) has been linked to many cardiovascular diseases such as familial combined hyperlipidemia (FCHL), which is characterized by elevated serum cholesterol or triglycerides. USF1 is a transcription factor involved in regulating lipid metabolism genes; accordingly, gene alterations in USF1 have been correlated with individuals with FCHL. In this study, human umbilical vein endothelial cells (HUVECs) were cultured and treated with siRNAs specific for USF1 to decrease USF1 protein expression. Densitometry of Western

blots for USF1 protein in both the cytoplasmic and nuclear compartments of the cell confirmed significant knock-down of USF1 protein. Immunocytochemistry (ICC) was performed to further examine USF1 protein knock-down in these HUVECs.

S. D. BERRY, M. P. COGAR, M. W. ELSWICK, L. M. HARRIS, T. G. W. JOHNSON, L. D. TAYLOR, and S. J. SAWYER, Department of Science and Mathematics, Glenville State College. **An Investigation into the Role of Intracellular Signaling During Flatworm Regeneration**

Planarian flatworms are well known for their ability to regenerate. However, the cellular signaling underlying this regeneration is not well understood. We treated regenerating flatworms (*Dugesia* sp.) with different pharmacological agents to observe how disruption of common intracellular signaling pathways affected the worm's ability to regenerate. Using the PI3-kinase inhibitor LY294002 at 1, 10, and 25 μ M, we found that these concentrations had no effect on flatworm regeneration when compared to controls. However, the PI3-kinase activator SC-3036 at 1 ng/mL speeded up regeneration. Flatworms incubated in 1 ng/mL SC-3036 regenerated heads in three days compared to controls, which required five days to reform a head. Interestingly, higher concentrations of SC-3036 did not have an effect on regeneration when compared to controls. We also investigated the effect of α -catenin signaling on flatworm regeneration. LiCl, which increases the α -catenin movement into the nucleus, affected regeneration by slowing head regeneration compared to tail regeneration. These data suggest that signaling through the PI3-kinase pathway may be important during regeneration. In addition, α -catenin may be involved in determining anterior-posterior patterning in these animals.

NOELLE JULIANO, MATTHEW K. DADDYSMAN, HAITAO LUO, and YI CHARLIE CHEN, Department of Biology, Alderson-Broadus College. **Kaempferol Inhibits Expression of VEGF and HIF-1 α in DU-145 Prostate Cancer Cells**
Prostate cancer is one of the most common cancers in western countries. Chemotherapy has not been a satisfactory method in treating this slow-growing type

of cancer. Kaempferol is a natural flavonoid found in many fruits and vegetables. The objective of our research is to determine the effect of kaempferol on cell proliferation, VEGF mRNA, and protein expression in DU-145 prostate cancer cells. The cell proliferation was conducted at different time points to establish the best time to treat the cells with kaempferol. Our results indicated that cell proliferation was significantly reduced when prostate cancer cells were treated with increasing doses of kaempferol. ELISA and Western blot assays detected the decrease of VEGF, HIF-1 α , and interleukin-6 protein expression in Du-145 cells treated with kaempferol. The inhibition of VEGF and HIF-1 α expression would hinder angiogenesis, tumor growth, and metastasis. (*Supported by NIH Grant 5P20RR016477 to the West Virginia IDeA Network for Biomedical Research Excellence*)

JOHN C. LANDOLT, JAMES C. CAVENDER, EDUARDO M. VADELL, and STEVEN L. STEPHENSON, Department of Biology, Shepherd University. **Dictyostelid Cellular Slime Molds Associated with Southern Beech (*Nothofagus*) Forests in Tasmania**

In May 2008, samples of soil/humus were collected from southern beech forests at a number of localities in western Tasmania. From the 100 samples, a total of 125 clones of dictyostelid cellular slime molds were recovered. The clones included representatives of at least four different described species and perhaps several forms that may be new to science. The results obtained in the present survey, when compared with those from similar surveys for dictyostelids on the Australian mainland, suggest that southern beech forests of Tasmania are not particularly hospitable to dictyostelids. The presence of high nematode populations and the relatively acidic character of the sample material may be, at least in part, responsible for the relative paucity of these organisms. This survey is preliminary and the records obtained represent the reports of dictyostelids from Tasmania. *The survey was supported by a grant from the National Science Foundation and resources were provided by Shepherd University, Ohio University, and the Universidad de Buenos Aires.*

JOYCE KRONBERG and MARSHALL GRIFFIN, Department of Natural Science/Mathematics, WVU at Parkersburg. **Making Your Own Anatomy and Physiology Models**

In Spring 2008, these two authors had students in Anatomy and Physiology class make models as part of a class project. The students worked in teams of two, had a size limit, and needed to include three recent references for the design of the model. The students then did a short (5–10-minute) presentation in class about their models. They discussed materials used, decisions about the scale, and areas labeled. The art projects turned out to be very well liked by students and extremely well done.

Health Sciences

SABARI SHRESTHA and TONY MORRIS, College of Science and Technology, Fairmont State University. **Carcinogenic Potential of Commonly Consumed Beverages and Spices using Bacterial Reverse Mutation Testing (Ames Test)**

The Ames test is the biological test to assess the mutagenic potential of chemical compounds. Positive results indicate that the chemical might be carcinogenic. This test is done by using a strain of *Salmonella typhimurium* that contains a mutation in the gene for histidine synthesis, so they require histidine for growth.

The main objective of the Ames test is to evaluate a chemical's carcinogenicity by measuring its ability to induce mutations. The Ames test is often the initial method of examining mutagenic potential. Ames test kits were purchased commercially (Presque Isle Cultures, Presque Isle, PA). The negative control was distilled water. The positive control was 4-nitro-*o*-phenylenediamine (4-NOPD) at a concentration of 100 μ g/mL. Glucose-minimal salts agar was inoculated with *Salmonella typhimurium* (TA98, Ames strain). This strain of *S. typhimurium* has a mutant gene in the biosynthesis pathway of histidine, but in the presence of a mutagen will revert and begin histidine biosynthesis. Since glucose-minimal salts agar has no histidine, the presence of colonies indicates that a reverse mutation has occurred. Substances to be tested (as well as controls) were autoclaved and applied to a sterile paper disc in the center of the Petri dish.

Revertant colonies grew around the paper disc and were counted and compared to controls.

Increased numbers of revertant colonies were observed for many substances examined. The test substances include cocoa, black pepper, green tea, and black tea. The plates that showed growth were compared with the positive and negative controls.

Science Education

EDWARD L. CRISP, Geology Department, West Virginia University at Parkersburg. **Student Attitudes Relative to Scientific Inquiry, Evolution, and Creationism in Introductory Science Courses at a Small College in West Virginia**

Science-attitude surveys that stressed the nature of scientific inquiry, acceptance of evolutionary theory, and belief in creationism were administered to 421 students in physical science, earth science, physical geology, astronomy, and some sections of biology at West Virginia University at Parkersburg during the interval from the summer of 2005 through the summer of 2007. About 50% of these students are elementary education majors, several of whom are specializing in science or math. Both pre-course surveys and post-course surveys were administered on an anonymous and volunteer basis. Results indicate that a high percentage of the students have a poor understanding of the nature of scientific inquiry and a large number of the students do not accept evolutionary theory. Further, the results appear to indicate that many believe in some form of creationism. Even the post-course surveys indicate that a high percentage of students favor the teaching of "creation science" alongside evolution in the science classroom. For example, pre-course surveys indicate that 59% of the 421 students think that "creation science" should be taught in the public schools alongside evolutionary theory. This decreased to only 51% for the 307 students that completed the post-course surveys. Further, although the majority (60% pre, 71% post) of the students surveyed accept biologic evolution as a fact, the students are less comfortable with the concept that modern man and modern great apes had a common ancestor several million years ago, with only 41% pre and 51% post accepting this view. With the dangers to science education inherent in the intelligent design-

creationism movement, explaining evolutionary theory and its strong basis in sound scientific inquiry in introductory college science classes is extremely important if we are going to prevent the teaching of pseudoscience in our public school science classrooms.

SUSAN L. SOWARDS, Department of Science, Parkersburg South High School and WVU Parkersburg (Adjunct Instructor). **Microfossil Classroom Activity to Facilitate Active Learning and the Nature of Scientific Inquiry for Middle School through High School Earth and Biological Sciences**

Most people associate paleontology with the study of large fossils like dinosaurs; however the little known field of micropaleontology can divulge equally fascinating microscopic fossils. In this classroom activity, students will see how seemingly lifeless pieces of rock often contain hidden treasures (miniature fossils), such as conodonts, foraminifera, and ostracods (to name a few) that are important to the understanding of Earth Science and the history and diversity of life on Earth. In this presentation you will receive information on how to obtain microfossils (including collection procedures), extraction of microfossils from shale samples using the kerosene method, identification of microfossils, and comparison of the morphology of different microfossil species from differently aged rocks and different paleoenvironmental conditions. Also discussed will be the answer to the question students always ask: "Why do we study microfossils?" Many microfossils are excellent "index fossils" (also called "time-guide fossils"), which indicate the geologic age of rock strata containing the fossils. These tiny jewels are also good paleoenvironmental indicators, most important in the fossil fuel and mining industries. Microfossils also provide evidence of biologic evolution and the rate of separation of continents via plate tectonic activities.

LISA CASTLE and Glenville State College Biology 305 Class, Department of Science and Mathematics, Glenville State College. **Data Compilation, Wild Plants, and College Students: How a Botany Project Has Helped Conservation and Educational Efforts**

As part of a botany course at Glenville State College, students were assigned plants to score using the United Plant Savers' At-Risk Assessment Tool. The rationale for this project was to meet both educational and conservation goals. Educationally, students face the challenges of learning how to filter through large quantities of information, how to assimilate information from many sources, and how to judge on-line material based on criteria other than entertainment value. Meanwhile, science educators strive to give students authentic science experiences and to integrate technology into fields traditionally seen as low-tech, such as botany. From the conservation stand point, a need for a concise compilation of information regarding wild-harvested plants was identified by the United Plant Savers, a non-profit group that has created a tool to rank plants based on their vulnerability to over-harvesting. Initial tests demonstrated that the assessment tool works qualitatively and mathematically, but the small number of plants scored has limited the usefulness of the tool. In this on-going project, students have self-reported increases in botanical knowledge and information retrieval skills, suggesting the project is useful educationally. Student scores of plants are consistent with scores from herbalists and botanists, suggesting that the data will make a valuable contribution towards a set of rankings useful in setting conservation priorities.

Psychology

RUTHIE M. PETTLE and JOHN H. HULL, Psychology Department, Bethany College. **College Students' Use of Rituals and Superstitions While Watching and Participating in Sports**

Eighty undergraduates (51 females, 29 males) 18 to 23 years of age completed a survey to assess: participation in varsity athletics; use of rituals or superstitions while participating in or watching sports; religious participation and attitudes about religious topics. Two-way, between-participants analyses of variance using participant gender and participation in varsity athletics as the independent variables were conducted for survey items. Overall, there were relatively few differences between those who had or had not played varsity athletics in college, except regarding use of superstitions or rituals while playing

sports. Varsity athletes were significantly more likely to use superstition or ritual: to bring luck and success to self and team; when the underdog; to reduce anxiety; for self-control; to boost confidence. On the other hand, there were many significant gender differences, all of them involving greater use of superstitions and rituals by males. For example, males were significantly more likely to: root, and root intensely, for football, men's basketball, and baseball teams; use a variety of superstitions or rituals while watching sports; use a variety of superstitions or rituals while playing sports, including 10 of the 19 specific rituals and superstitions mentioned in the survey. Finally, correlational analyses showed that religious participation and attitudes about religious topics were poor predictors of ritual and superstition use in the area of sport. Future research needs to address the possibility that different results might occur when NCAA Division I or II, rather than Division III, varsity athletes are participants.

Chemistry

TETSUYA YAMAMOTO, GABE GIBBS, and DAVID O'DELL, Science and Mathematics Department, Glenville State College. **Evaluation of a Portable Visible Spectrophotometer and Data Logger for Colorimetric Analysis**

An Ocean Optics *Red Tide* spectrophotometer interfaced to a Pasco Xplorer GLX data logger was used to determine concentrations of Cu^{2+} , Co^{2+} , and Ni^{2+} in aqueous solution. Wavelength scans were conducted to determine the wavelengths of maximum absorption (λ_{max}), and then analyses were performed at the λ_{max} for each element to determine the range over which Beer's law is valid and to evaluate instrument detection limits. Solutions ranging from 0.001 mol L^{-1} to 1 mol L^{-1} were analyzed to construct standard curves and to evaluate linearity of response; analyses were duplicated on a Varian Cary 50 Probe UV-visible spectrophotometer for comparison. The λ_{max} determination on the *Red Tide* was comparable to that of the Cary, and molar absorptivities were similar for the two spectrophotometers. Linear range and instrument detection limit varied for each element, but were slightly better on the Cary than on the *Red Tide*.

Engineering

JUSTIN ESPELAND, DEREK COOPER, and KEVIN D'ANGELO, Department of Computer Science, Mathematics, and Engineering, Shepherd University. **Bike Stability**

Our research is based on the stability of bicycles. We have covered the gyroscopic forces of the front and rear wheels and the moments of the frame and different steering axes. During our research we have conducted several experiments both riding and on test bikes for values, such as critical velocity and the different effects from gyroscopic forces on the bike. We have concluded, and proved from our tests, the importance and effect of critical velocity, caster angle, and trail for the stability and handling of a bicycle

MEILIN LIU, XINCHAO WEI, and BENOIT VAN AKEN, Department of Civil & Environmental Engineering, West Virginia University. **Oil Shale Bioextraction Using Thermophilic Bacteria and Archaea**

Oil shale resources in the U.S. have the potential to make a significant contribution to the nation's energy independence. Extraction of oil shale at temperatures of 500°C to 750°C (i.e., retorting) results in high energy consumption and pollutant emissions. The potential of using microorganisms for oil shale bioextraction is limited by the low temperature normally compatible with living organisms. In this research, we test the capability of thermophilic bacteria and Archaea for bioextraction of oil shale at a higher temperature. Oil shale samples were crushed into particles (less than one mm) and introduced into a mineral-based medium at a concentration of 1.5% in weight. The mixtures were inoculated with microorganisms collected from different sources, including the oil shale itself, and incubated at 65°C and 165 rpm for 6 weeks. Our results showed that thermophilic microorganisms were growing using oil shale components as sole sources of carbon and energy. Characterization of the microbial community based on 16S rDNA showed the presence of several bacterial and Archeal species. Analysis of petroleum products in the liquid medium using GC/MS did not reveal significant amounts of hydrocarbons, suggesting that growing bacteria were using entirely

the hydrocarbons released as electron donors. Generation of gas (e.g., methane) from oil shale mixtures is currently under investigation. Further experiments will include incubation of oil shale at a higher temperature (85°C) in order to improve petroleum product leaching and the use of additional sources of microorganisms, e.g., from hot springs and industrial cooling systems, potentially resulting in higher extraction efficiencies.

Geology

E. RAY GARTON, Curator, WV Geological Survey, 1 Mont Chateau Road, Morgantown, WV 26508 (curator@prehistoricplanet.com) and DAVE PHILLIPS, Sunset Fossils, Morgantown, WV 26505 (wvfossils@aol.com). **Definitive Fossil Evidence of *Dunkleosteus* (Placodermi), an Extinct Armored Fish, from the Foreknobs Formation (Devonian) of West Virginia**

Definitive fossil evidence in the form of the medial dorsal plate and keel of *Dunkleosteus*, a large Placoderm armored fish, has been found in the Devonian age Foreknobs Formation near Elkins, WV. Devonian strata and fossils are abundant in West Virginia but this represents the first undisputed record of this genus from the state.

Computer Science

JAMES CONRAD, Biology Department, Fairmont State University. **Predicting Potential Wind Farm Sites in West Virginia Using Geographical Information Systems**

Geographical Information Systems (GIS) technology is a system used to manage, interpret, and project spatial data. In this project, GIS was employed to analyze existing and predict potential wind energy sites in West Virginia. During the course of the research, GIS was used to compare the acreage of surface mines vs. wind farms and potential energy output, predict future sites of wind farms, and to determine the impact on viewsheds from existing wind farms in the state.

Wind farms in the U.S. produce less than one percent of power found on the grid. The USDOE predicts 20% wind power by 2030. By 2030 coal-fired power plants will account for more than 54% of domestic electrical energy needs; 60% of that coal will be produced by surface mines.

There are two existing wind farms in WV. When combined they cover an area of approximately 12,400 acres with a combined total of 210 turbines. Each turbine is rated at a capacity of 1,500 kWh. Annual energy production by these turbines running at 30% capacity is projected to total over 667,000,000 kWh.

Surface mining in WV is an efficient way to reach much of the coal resource in the state. There are approximately 85,000 acres of active, permitted surface mines in the state. That is six times greater area than both wind farms.

GIS allows developers to input their specifications and find their goals with data that is already available. Through the use of GIS the goal of 20% wind energy on the grid by 2030 can be reached more quickly and at a lower cost.

DAVID CRITES, ERIC JORDAN, and WEIDONG LIAO, Department of Computer Sciences, Mathematics, and Engineering, Shepherd University. **A Survey on Power-Aware Computing System Design**

In this survey we provide a high-level overview to design options towards a "green" computing system. We examine the amount of energy consumed by a computer system and techniques in which to operate within a power-controlled environment. Subsystems where power-aware technologies are implemented in order to streamline power throughout a process are studied. Organized in a hierarchical structure, these subsystems include instruction set architecture, clustering, GPU power consumption, web server utilizing in-kernel Apache, and virtual memory applications.

We analyze the ability and usage of dynamic voltage scaling to deliver and use only the power needed to complete a task. Based on the principle of power-aware design we are not directly stating that it will result in minimizing overall power. Through some implementations of the power-

aware techniques, overall power consumption is increased but the extreme highs and lows of power usage are minimized resulting in a more power-controlled environment. Within the web server environment the instantiation of a kHTTPd daemon in order to maximize power-aware capabilities is introduced based on its ability to run within the Linux kernel. Though the in-kernel use may not foster the capability to provide dynamic content, its efficiency in coordinating the file access scheduling provides a system that is much more power-aware than its counterpart.

The study of a systems energy consumption and steps necessary to minimize the overall consumption can decrease the strain on the environment as well as allow for minimal life-cycle cost.

Finally, *SPECpower*-proposed benchmarks for power-efficient IT systems are discussed.