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Academy of Science
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Table of Contents

ORAL PRESENTATIONS

(* indicates undergraduate student, ** indicates graduate student)

BIOCHEMISTRY

ALEXANDRA ROBERTS* and BRUCE ANTHONY, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26101. **Alcohol-induced cell cycle changes in G1–S phase transition in rat neuronal embryonic dorsal root ganglion stem cells.**

JENNA WRIGHT*, ANDREA RENSHAW, DENNIS GOOCH, JOSEPH HORZEMPA, and ROGER SEEBER, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Assessment of nectar surrogates and their efficacy as an environmental reservoir of Francisella spp. promoting mosquito colonization.**

BOTANY

JADE BENNETT* and DONALD TRISEL, Department of Biology, Fairmont State University, Fairmont, WV 26554. The science and the folklore of medicinal plants in WV used in treating arthritis.

ANDREA RENSHAW* and JENISE BAUMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26003. **Edtomycorrhizal composition on American chestnut during establishment on restored landscapes.**

LAUREN SIBURT* and DONALD TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont Statee University, Fairmont, WV 26554. **Historical and modern uses of medicinal plants in treating joint and muscle problems.**

JUDITH URBANIC*, MARTENEY JACOBS*, and ALAN M. DANIEL, Department of Behavioral Sciences, Glenville State College, Glenville, WV 26351. **An inexpensive, automated apparatus for measuring consummatory behavior in restrained honey bees.**

TIFANY WOODSON*, MARK FLOOD and DONALD TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont State University, Fairmont, WV 26554. **The comparative allelopathic effects of invasive plants on *Lactuca Sativa.***

COMPUTER SCIENCE

CHAD VANORSDALE*, WEIDONG LIAO and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **Firefox OS: a comparative analysis of web apps.**

HENRY WARE, MModal, Inc. Morgantown, WV 26505; JOHN ATKINS and RAYMO9ND MOREHEAD, Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV 26506. **A note on second normal form.**

ECOLOGY

SPENCER BELL* and ZACHARY J. LOUGHMAN, Department of Natural Sciences and Mathematics, West liberty University, West Liberty, WV 26074. **Life history of *Orconectes obscurus* in northern West Virginia.**

JESSICA CHANEY*, Department of Chemistry, Shepherd University, Shepherdstown, WV, 25443, and CAROL Z. PLAUTZ, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **The link between disturbances in reproduction and expression of enzymes in the steroidogenic pathway in aquatic invertebrates exposed to components of the herbicide Roundup.**

RAQUEL FAGUNDO*, EVAN LAU, E. JOSEPH NOLAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074; ROGER THOMA, Midwest Biodiversity Institute, Columbus, OH 43221-0561; ZACHARY J. LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Taxonomic standing of *Cambarus sciotensis* (Teays River crayfish) in West Virginia.**

DAVID FOLTZ II*, THOMAS JONES, Integrated Science and Technologies Department, Marshall University, One John Marshall Drive, Huntington WV 25755; ZACHARY LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074-029. **Morphometric and reproductive analysis of *Cambarus cf. robustus,* a newly described species of Cambarid crayfish from the Twelvepole watershed in West Virginia.**

LAUREN GATES* and MARK FLOOD, Department of Biology, Chemistry and Geoscience, Fairmont State University, Fairmont, WV 26554. **Determination of the effects of Marcellus shale drilling and fracking on local stream composition.**

JENNIFER GOGGINS* and MARK FLOOD, Department of Biology, Chemistry and Geoscience , and JONATHAN ADAMS, Exercise Science, Fairmont State University, Fairmont, WV 26554. **Determining the effect of thalidomide on Bullfrog tadpole development.**

MICHELE GROVES* and MARK FLOOD, Department of Biology, Chemistry, and Geoscience, Fairmont State University, Fairmont, WV 26554. **Determining the long-term and short-term effects of nonylphenol on *Daphnia magna.***

BENJAMIN HACKETT* and CAROL Z. PLAUTZ, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Investigating the cellular basis of long-term memory formation and disruption in the pond snail, *Lymnaea palustris.***

JESSICA HARVEY* and KIMBERLY A. BJORGO-THORNE, Department of Biology and Environmental Science, West Virginia Wesleyan College, Buckhannon, WV 26201. **Cattle excretions affect nitrate loading within nutrient-poor streams in Upshur County, WV.**

JUSTIN HILLIARD* and PHILLIP YEAGER, Department of Biology, Chemistry, and Geoscience, Fairmont State University, Fairmont, WV 26554. **Microbial community ecology of the West Fork River.**

CLAIRE JUSZCZAK*, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV; ZACHARY LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV. **Results of the first butterfly survey of Hancock County, West Virginia.**

ZACHARY J. LOUGHMAN, Department of Natural Science and Mathematics, West Liberty University, West Liberty, WV 26074. **Should I stay or should I go? Determining the movement patterns of male New River crayfish through use of radio telemetry.**

SAMANTHA MINES* and CAROL Z. PLAUTZ, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Investigating reproductive and developmental abnormalities in the aquatic invertebrate *Lymnaea palustris* exposed to components of the herbicide Roundup.**

ENGINEERING

JAMES T. ANDERSON, West Virginia University, Environmental Research Center, PO Box 6125, Morgantown, WV 26506; JONATHAN L. PITCHFORD, The Institute for Marine Mammal Studies, Gulfport, MS 39502; STEPHEN M. SELEGO, Division of Forestry and Natural Resources, West Virginia University, KATHRYN R. P. McCOARD, West Virginia University, Division of Forestry and Natural Resources, Morgantown, WV 26506; LIANSHIN LIN, West Virginia University, Department of Civil and Environmental Engineering, Morgantown, WV 26506; GEORGE T. MEROVICH, Jr., West Virginia University, Division of Forestry and Natural Resources, STUART A. WELSH, West Virginia University, Cooperative Fish and Wildlife Research Unit, Morgantown, WV 26506. **Biotic and abiotic response to stream restoration on the Cacapon River.**

NICHOLAS L. HILLEN** and JOHN M. KUHLMAN, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506. **Single impinging droplets on a preexisting liquid surface using high-speed video imaging visualization techniques for bottom cavity size.**

MAHMOOD HOSSAIN, Department of Computer Science, Fairmont State University, Fairmont, WV 26554, TADASHI KATO, Department of Behavioral, Fairmont State University, Fairmont, WV 26554, and MICHAEL SINK, Department of Computer Science, Fairmont State University, Fairmont, WV 26554. **Frequency spectrum analysis of multichannel EEG using auditory stimuli of varying fractal dimensions.**

ANVEEKSH KONERU**, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26505, and TERENCE MUSHO, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26505. **Computational predictions of thermoelectric properties of cobalt spinels using *ab initio* methods.**

STEVEN MCCLELLAND** and JOHN ZANIEWSKI, Department of Civil and Environmental **Engineering,** Statler College of Engineering and Mineral Resources, West Virginia University, P.O. Box 6103, Morgantown, West Virginia 26506-6103. **The West Virginia contribution to America's first asphalt roads.**

LYNDSAY RANKIN** **and ANNE AXEL, Department of Biological Sciences, Marshall University, Huntington, WV 25755. Assessment of landscape degradation using Landsat images and vegetation sampling in southern Madagascar.**

MICHAEL SNYDER** and LESLIE HOPKINSON, Department of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. **The hydrologic response of valley fills with alternative reclamation methods.**

JONATHAN TAUB**, EDWARD M. SABOLSKY and THOMAS EVANS, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV. **Design, fabrication and characterization of a Surface Acoustic Wave sensor based on PZT thin film for the detection of hypergolic fuels during satellite refueling in the GEO stationary orbit.**

J. STEPHEN TAYLOR** and JOHN M. KUHLMAN, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506. **Experiments used to improve and validate Monte-Carlo simulation spray cooling model.**

TIMOTHY WEADON**, EDWARD M. SABOLSKY, and THOMAS EVANS, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV. **Strategic design of a 0:3 ceramic:polymer composite capacitive sensor array for haptic feedback in robotic space servicing applications.**

MICROBIOLOGY

SAMANATHA BOLYARD*, LINDSEY DODRILL, STEVEN ROOF and DONALD TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont State University, Fairmont, WV 26554. **The effectiveness of plant extracts on the inhibition of bacterial growth.**

BRIANNA N. COWAN**, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Genetic modification of *Francisella tularensis* LVS to create a novel vaccine against *Pseudomonas aeruginosa.***

KALA DURHAM* and STEVEN ROOF, Department of Biology, Chemistry and Geoscience, Fairmont State University, Fairmont, WV 26554. **Determining the sanitizing capability of the Steri-Pod.™**

JOSEPH HORZEMPA, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Identification of bacterial factors that mediate erythrocyte invasion by *Francisella tularensis.***

PHYSICS

MERIKA KHURANA*, Department of Biology, Shepherd University, Shepherdstown, WV, 25443; JEFFREY GROFF, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Estimating the Boltzmann constant using simulations to fit experiments of settling Brownian particles.**

TREY KNEPPER*, , Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Is photovoltaic (PV) energy output more affected by tilt angle or azimuth angle?**

PSYCHOLOGY

AMANDA MADURSKI* and JOHN H. HULL, Department of Psychology, Bethany College, Bethany, WV 26032. **Gender stereotyping in Halloween costumes: scary results.**

ALBERT MAGRO, Department of Biology, Fairmont State University, Fairmont, WV 26554. **Hominid evolution and the aesthetic response to fashion and cosmetics.**

SCIENCE EDUCATION

NICHOLAS WILBUR** and MICHELLE WITHERS, Department of Biology, West Virginia University, Morgantown, WV 26506. **Variation in the teaching of evolution in post-secondary education.**

ZOOLOGY

THOMAS K. PAULEY, Department of Biological Sciences, Marshall University, Huntington, WV 25755; BETH ANNE PAULEY, Department of Natural Sciences and Mathematics, University of Charleston, Charleston, WV 25304. **Nests of the Redbacked salamander *(Plethodon cinereus)* in the upland forest of West Virginia.**

POSTER PRESENTATIONS

ASTRONOMY

BRITTANI LOVE and JASON BEST, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Analysis of quasar distributions in the local universe.**

BOTANY

DONALD E. TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont State University, Fairmont, WV 26554; CHRISTOPHER R. HARDY, James C. Parks Herbarium, Department of Biology, Millersville University, Millersville, PA 17551. **The Fairmont State Flora Project on the WikiPlantAtlas©.**

AUTUMN WYATT*, DEVON WILLIAMS*, and MARK B. WATSON, Department of Natural Science and Mathematics, University of Charleston, Charleston, WV 25304. **The effect of the biocide triclosan on *Onoclea sensibilis* and *Osmunda claytoniana*.**

CELL BIOLOGY / GENETICS

LAURONZA HARMON,* ALICE MAGRO and ALBERT MAGRO, Department of Biology, Fairmont State University, Fairmont, WV 26554. **Increase in membrane-bound ADAM 10 and 12 on the surface of apoptotic LN18 cells.**

MARTENEY JACOBS*, DYLAN TOMBLIN* and RANDY SMITH*, Department of Science and Mathematics, Glenville State College, 200 High Street, Glenville, WV 26351. **Transformation and purification of recombinant DNA from a test plasmid to be applied to protein kinase A for structure-function relationships of Cγ.**

REBECCA JENNINGS*, STEPHANIE SINGLETON* and DAVID B. WING, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Characterization of a spontaneous partial revertant of the mutant vestigial wing gene of *Drosophila melanogaster.***

DARRYL JOHNSON*, Department of Computer Sciences, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443; LOGAN LYDA*, Department of Chemistry, Shepherd University, Shepherdstown, WV 25443; DAVID J. KLINKE, Department of Chemical Engineering, and Department of Microbiology, Immunology and Cell Biology, West Virginia University, Morgantown, WV 26506; ZHIJUN WANG, Department of Computer Sciences, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443; JONATHAN BRAMSON, Department of Pathology and Molecular Medicine, McMaster University, Hamilton, Ontario, Canada L8S 4L8; QING WANG, Department of Computer Sciences, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443; TIMOTHY HOOVER*, BRITTANY POLING*, and BURTON LIDGERDING, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Numerical simulation of a multi-scale tumor growth model by genetic algorithm.**

ANDREA B MINIGH*, MEAGAN M. LESSER, MORGAN A. SCARPELLINI, TYLER S. TURNER*, and SARA J. SAWYER, Department of Science and Mathematics, Glenville State College, Glenville, WV 26351. **The effect of increased water temperature on integrin distribution and integrin-related signaling and gene expression in the tropical symbiotic anemone, *Aiptasia pallida.***

DAVID RUSSELL* and BRUCE ANTHONY, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26101. **Proteomic and genomic analysis of bronchial epithelial cell lines transfected with the cystic fibrosis transmembrane conductance regulator.**

DAVEY WRISTON* and BRUCE ANTHONY, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26101. **Effects of varying alcohol concentrations on embryonic mouse neural stem cell differentiation.**

CHEMISTRY

TIFFANY CLEMENTS*, EDWARD A. WOVCHKO, and JOANNA WEBB, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Ligand screening for a Pt alkene oxidation catalyst.**

ROBERT B. DEWEES* and KEVIN L. EVANS, Department of Science and Mathematics, Glenville State College, Glenville, WV 26351. **Electrophilic aromatic substitution lab**

ADAM FINNISS**, SUSHANT AGARWAL, and RAKESH GUPTA, Department of Chemical Engineering, West Virginia University, Morgantown WV 26506. **Structure and properties of blended polylactic acid and polycarbonate.**

JOANNA GAINES* and MELISSA CHARLTON-SMITH, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Adaptation of gas detection tube chemistry to wet analysis of organohalide liquid waste compounds.**

JESSICA HARVEY* and MELISSA CHARLTON-SMITH, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Colorimetric determination of the release of bromide ion or bromine radical during Grignard reagent formation.**

JACOB KNICELY* and BRUCE ANTHONY, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26101. **Examination of topical application of ibuprophen.**

SARA MORRIS* and EDWARD A. WOVCHKO, Department of Chemistry, West Virginia Wesleyan College, 59 College Avenue, Buckhannon, WV 26201. **Preparation and GCMS analysis of perfume samples for an analytical chemistry laboratory experiment.**

COMPUTER SCIENCE

JASON BERTMAN* and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **Using elliptic curve cryptography to secure web applications.**

JORDAN CANNIN*, JESSICA NOVAK*, WEIDONG LIAO and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **Analyzing and securing the mobile world.**

BRADLEY HAMMOND* and HYOIL HAN, Weisberg Division of Computer Science, Marshall University, Huntington, WV 25755. **ReelAdvice+: a movie recommender system ReelAdvice+ is a research project on recommender systems.**

ALEX KING* and HYOIL HAN, Weisberg Division of Computer Science, Marshall University, Huntington, WV 25755. **Outlier detection on keystroke biometric data using data mining.**

CAMERON J. LOADER*, HYOIL HAN, Weisberg Division of Computer Science, LAURA ADKINS, Department of Mathematics, ELKE FAHRMANN, HENRY K. DRISCOLL, Joan C. Edwards School of Medicine, Marshall University, Huntington, WV 25755**. Data mining for diabetes medical data**

MATTHEW MOCNIAK* and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **The user interface: importance and good practice..**

SEAN SOVINE* and HYOIL HAN, Weisberg Division of Computer Science, Marshall University, Huntington, WV 25755. **Query enrichment in multi-document summarization.**

CHAD VANORSDALE* and WEIDONG LIAO, Department of Computer Science, Mathematics and Engineering, School of Natural Sciences and Mathematics, Shepherd University, Shepherdstown, WV 25443. **On the security and privacy concerns of the cloud.**

TYLER WALDRON*, WEIDONG LIAO and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443**. 'Breaking' AES.**

ECOLOGY

JONATHAN BARNETT*, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Utilizing ASAR imagery for long-term monitoring of a continuous oil seep in the Gulf of Mexico.**

RAQUEL FAGUNDO*, MICHAEL LUCERO, and ZACHARY LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Results of the first survey of northern West Virginia's centipede fauna.**

JESSE KING*, RICK SYPOLT and RICO GAZAL, Department of Land Resources, Glenville State College, Glenville, WV 26351. **Determining Eastern coyote population on Glenville State College Forest.**

JOHNNY KING* and RICO GAZAL, Department of Land Resources, Glenville State College, Glenville, WV 26351. **Forest stand management techniques and rainfall amounts improve diameter growth of yellow poplar *(Liriodendron tulipifera).***

KELLI LIGHTHISER*, NICOLE SADECKY, RAQUEL FAGUNDO, MICHAEL LUCERO, E. JOSEPH NOLAN, and ZACHARY LOUGHMAN, Department of Natural Resources and Mathematics, West Liberty University, West Liberty, West Virginia 26074. **Crayfishes of the New and Gauley River basins of West Virginia: conservation and natural history.**

KASSEN LLOYD*, JUSTIN HILLIARD*, JOSHUA VANOSDOL* and DONALD TRISEL, Department of Biology, Chemistry, and Geoscience, Fairmont State University, Fairmont, WV 26554. **Floristic survey of a managed, mixed mesophytic forest in Marion County WV.**

MICHAEL LUCERO*, RAQUEL FAGUNDO, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV; STUART WELSH, U.S. Geological Survey, West Virginia Cooperative Fish and Wildlife Research Unit, Morgantown, WV; ZACHARY LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV. **Distribution and conservation status of four *Orconectes* crayfishes occurring in Virginia's Upper James and Maury River systems.**

AMY PARSONS-WHITE**, Department of Physical Science, Marshall University, Huntington, WV 25755. **Modeling surface water flow and sediment transport in the Twelvepole Creek watershed.**

ADRIAN PATTERSON*, ADAM WILSON*, and ROSS CONOVER, Department of Science and Mathematics, Glenville State College, 200 High St, Glenville, WV 26351. **Influence of free-ranging cats on Carolina wren nestling feeding rates.**

ENGINEERING

BORJA CANTO-TUBILLA**, CHUNCHUAN XU, JOHN ZONDLO, ANNA MCCLUNG, Department of Chemical Engineering, West Virginia University, Morgantown, WV 26505; KATARZYNA SABOLSKY, EDWARD SABOLSKY, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26505. **Direct carbon fuel cells: performance and degradation mechanisms.**

MURAT DINC** and DONALD D. GRAY, Department of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. **Computational investigation of isothermal sprays: effect of nozzle-to-surface distance and spray angle.**

JENNIFER GORE*, TIMOTHY WEADON, EDWARD M. SABOLSKY, THOMAS EVANS, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV. **Fabrication and testing of Piezoresistive tactile sensors.**

STEPHEN HAYES**, Department of Mechanical and Aerospace Engineering Center for Alternative Fuels, Engines and Emissions, West Virginia University, Morgantown, WV 26506. **Laboratory for film cooling analysis of gas turbine engines.**

TREY KNEPPER*, RICK EGNER and CLARISSA MATHEWS, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Reducing grid-dependent energy use in campus dormitories through conservation and renewable energy.**

LAUREN KING*, JEFFREY GROFF, and CLARISSA MATHEWS, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Observations of the thermal properties of a solar-thermal greenhouse using an Arduino-based temperature sensor.**

LAUREN KING*, GRAHAM HORNE, and CLARISSA MATHEWS, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Reducing grid-based electricity consumption in an historic campus structure: An in-depth energy audit and renewable energy site evaluation of Miller Hall.**

ANITESH ANAND LAL** and TERENCE MUSHO, Mechanical and Aerospace Department, West Virginia University, Morgantown, WV 26506. **FDTD simulation of a broadband fractal meta-material absorber.**

TIMOTHY REPKO**, Department of Mechanical and Aerospace Engineering Center for Alternative Fuels, Engines and Emissions, West Virginia University, Morgantown, WV 26506. **A parametric numerical study of the effects of freestream turbulence intensity and length scale on anti-vortex film cooling design at high blowing ratio.**

ZOE SUMRALL*, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Comparison of theoretical and measured data of photovoltaic energy output.**

JONATHAN TAUB**, EDWARD M. SABOLSKY, THOMAS EVANS, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26505. **Design, fabrication and characterization of a surface acoustic wave sensor based on PZT thin film for the detection of hypergolic fuels during satellite refueling in the GEO stationary orbit.**

MATTHEW S. THOMPSON**, SUSHANT AGARWAL, and RAKESH K. GUPTA, Department of Chemical Engineering, West Virginia University, Morgantown, WV 26506. **Morphology development in PC/SAN blends: roles of extensional flow and nanoparticle stabilization.**

MICROBIOLOGY

SAMANATHA BOLYARD*, JOHN LOWTHER, STEVEN ROOF and DONALD TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont State University, Fairmont, WV 26554. **The effectiveness of natural products on the inhibition of bacterial growth in nutrient broth.**

TARA GAJTKA* and JAMES BIRCH*, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Temperature-dependent antibiotic resistance of pathogenic bacteria.**

PSYCHOLOGY

MATTHEW FERGUSON*, JORDAN PARIS and HYOIL HAN, Weisberg Division of Computer Science, Marshall University, Huntington, WV 25755. **Semantic-based classification for sentiment analysis of movie reviews.**

JORDAN PARIS* and HYOIL HAN, Weisberg Division of Computer Science, and WON-YUL BAE, Department of Health Profession, Marshall University, Huntington, WV 25755. **Twitter sentiment analysis for a sports team.**

ZOOLOGY

NATHAN BRANDT*, SARAH BARRY* and CLARISSA MATHEWS, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Targeting Brown marmorated stink bug *(Halyomorpha halys)* nymphal development via biologically-derived sprays.**

ZOE CHARALAMBOUS* and CAROL Z. PLAUTZ, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Promoting the pond snail *Lymnaea palustris* as a useful model for developmental biology experimentation.**

CHRISTINE KANNEH* and RUTH A. CONLEY, Biology Department, Shepherd University, Shepherdstown, WV 25443. **Quantitation of communication signals in *Aleuropoda insignis,* the "Flat-horned" hissing cockroach.**

BRENNAN PEDIGO*, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Migratory bird nesting rates in a constructed area.**

CLAYTON RAINES*, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Acute toxicity of road salt on freshwater amphipods.**

WENDI WENTZELL*, Department of Natural Science and Mathematics, West Liberty University, West Liberty, WV 26074. **Nursery web and Fishing spiders (Pisauridae: *Pisaurina, Dolomedes)*: observations on distribution and natural history in West Virginia.**

RHONDA WILLIAMS*, DAN DILELLA, and RUTH A. CONLEY, Biology Department, Shepherd University, Shepherdstown, WV 25443. **HPLC identification of octopamine in the hemolymph of *Gromphadorhina portentosa,* the Madagascar hissing cockroach.**

ORAL PRESENTATIONS

(* indicates undergraduate student, ** indicates graduate student)

BIOCHEMISTRY

ALEXANDRA ROBERTS* and BRUCE ANTHONY, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26101. **Alcohol-induced cell cycle changes in G1–S phase transition in rat neuronal embryonic dorsal root ganglion stem cells.**

Previous studies show that prenatal alcohol exposure induces fetal alcohol spectrum disorder dysmorhology. It is thought that alcohol affects proliferation, differentiation and/or migration of developing neural crest stem cells. Our preliminary studies using adult rat dorsal root ganglion stem cells (a derivative of the neural crest) show that G1 cell cycle regulatory proteins, including cyclin D1 and the transcription factor E2F1, increased in expression after alcohol exposure. Under normal cell cycle progression, the G1 to S phase transition is induced by binding of cyclin D1 to CDK4/6 and subsequent phosphorylation of retinoblastoma protein (pRB) with releasing E2F1 transcriptional activation of S-phase genes. Misregulation of these events is known to alter cell cycle progression, DNA synthesis, and induced apoptosis. Our current work shows alcohol increased expression of phosphorylated pRB and altered cell cycle G1 and S progression when examined by BrdU labeling. Using flow cytometry, we examined a G1 gated population of cells that demonstrate changes in G1 progression with accumulating cells at late G1 prior to S phase. We also demonstrate increased expression of p53, known to induce apoptosis during DNA repair. We suggest that uncoordinated expression of cell cycle regulators, and uncontrolled cell cycle checkpoint control could be primary mechanisms by which stem/progenitor cells lose proliferation potential and undergo apoptosis after alcohol exposure.

JENNA WRIGHT*, ANDREA RENSHAW, DENNIS GOOCH, JOSEPH HORZEMPA, and ROGER SEEBER, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Assessment of nectar surrogates and their efficacy as an environmental reservoir of *Francisella* spp. promoting mosquito colonization.**

Francisella tularensis is a dangerous bacterium that causes the disease tularemia. It is hypothesized that it could live in the nectar of flowers. Arthropods, specifically mosquitoes, could possibly be a vector for this pathogen, transmitting it to humans after feeding on nectar. The survival of *F. tularensis* was examined in sucrose solutions (60%, 30%, and 10%), honey, agave nectar, and blackberries to imitate what mosquitoes feed on. Three species of *Francisella* were used in testing, *F. tularensis* live vaccine strain (LVS), *Francisella novicida,* and *Francisella philomiragia*. Solutions were inoculated with the three strains separately and plated for seven days. In the plating process, solutions were diluted and plated on chocolate agar with isovitalex plates, using the drip technique. After an incubation period under the conditions of 37 degrees Celsius and 5% carbon dioxide levels, viable colony forming units (CFU) were enumerated.

Initial results show that the survival in each strain was best in sucrose solutions rather than diluted honey, agave nectar, or blackberries. Therefore, this suggests that *F. tularensis* may not utilize flower nectar as a reservoir for mosquito-borne tularemia.

BOTANY

JADE BENNETT* and DONALD TRISEL, Department of Biology, Fairmont State University, Fairmont, WV 26554. **The science and the folklore of medicinal plants in WV used in treating arthritis.**

This study examines the historical and modern uses of medicinal plants in WV to treat

problems associated with joints and muscles. Plants included in this study are *Oenothera biennis* (evening primrose), *Rhododendron maximum* (great rhododendron), *Salix x pendulina* (weeping willow), and *Sassafras albidum* (sassafras). Herbarium specimens in the Fairmont State collection (FWVA) were examined, verified, digitized and photographed. New collections of these species and other medicinal plants were digitized as well. Literature searches were conducted to examine the benefits of specific compounds within these species.

When this study began, FWVA held four *O. biennis* specimens, seven *R. maximum*, one *S. x pendulina,* and twelve *S. albidum*. According to the Checklist and Atlas of the Vascular Flora of West Virginia (Harmon, Ford-Werntz, and Grafton 2006), these species are found in 50, 33, 13, and 54 WV counties, respectively. Our new collections and the specimens already held in FWVA will update the county maps published in the Atlas. Evening primrose contains linoleic acid, which is converted into gamma-linolenic acid (GLA). The human body converts GLA to another group of anti-inflammatory prostaglandins. Weeping willow contains salicylic acid in its fresh bark, which causes inhibition of prostaglandin synthesis in sensory nerves to reduce pain. When applied topically, safrole in the sassafras acts as an anti-inflammatory, although some individuals experience a contact dermatitis. Safrole is also known to be hepatotoxic and carcinogenic. The great rhododendron produces kaempferol, which has anti-inflammatory effects.

ANDREA RENSHAW* and JENISE BAUMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26003. **Ectomycorrhizal composition on American chestnut during establishment on restored landscapes.**

The American chestnut *(Castanea dentata)* was once an important staple of Appalachian ecology and economy. Chestnut blight *(Cryphonectria parasitica)* caused large-scale mortality to the native Appalachian range by the 1950s. As a control measure, backcross breeding programs were established in the 1980s. This program uses Chinese chestnuts, which are naturally resistant to *C. parasitica,* crossed with American chestnuts. Hybrid blight-resistant progeny are then backcrossed with an American parent to produce the American chestnut morphology with blight-resistance genes. As part of a long-term restoration, backcrossed 15/16th American chestnuts were incorporated in a coal mine restoration project in central Ohio. Important for chestnut establishment are ectomycorrhizal (ECM) fungi, mutualistic symbionts in association with chestnut roots. This current study was part of a five year project comparing ECM fungal interactions during chestnut establishment. Root tips from chestnuts were sampled, examined for fungal sheaths, and sequenced to fungal genera using the ITS region of fungal DNA. After five growing seasons, chestnut growth was positively correlated with ECM root colonization. The most abundant ECM species sampled in 2008 was an introduced *Hebeloma* species. In 2012, this species was replaced by another introduced ECM fungus, *Cortinarius.* This change in species rank could be a seasonal pattern allowing for the co-existence of *Hebeloma* and *Cortinarius.* Alternatively, *Cortinarius* may be better adapted to this field site and outcompeted Hebeloma for chestnut root after five years. This finding is being incorporated into greenhouse inoculations using *Cortinarius* prior to outplanting to increase seedling survival in coal mine restoration projects.

LAUREN SIBURT* and DONALD TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont State University, Fairmont, WV 26554. **Historical and modern uses of medicinal plants in treating joint and muscle problems.**

This research was designed to examine plants found in WV that have been used historically or currently in medicine, particularly in treating joint in muscle problems. The plants examined include *Urticadioica, Hamamelisvirginiana,*

Achilleamillefolium, and *Phytolaccaamericana.* Specimens found in the Fairmont State herbarium (FWVA) were examined, verified, digitized and photographed. New collections of these species and other medicinal plants were digitized as well. Literature searches were conducted to examine the benefits of specific compounds within these species.

Prior to collecting new specimens, there were twelve specimens of *H. virginiana,* fourteen *A. millefolium,* thirteen *P. americana,* and four specimens of *U. dioica* found in FWVA. The first three species have all been documented throughout WV, whereas U. dioica has only been documented in about ten counties (Checklist and Atlas of the Vascular 25 Flora of West Virginia by Harmon, Ford-Werntz, and Grafton 2006). Our collections and the specimens documented in FWVA will provide updates to the Atlas. The active compound in *U. dioica* is formic acid, which causes circulation to be stimulated in treating arthritis and paralyzed limbs. Tannic acid or tannin is found in *H. virginiana* and is thought to have medicinal uses for arthritis, anti-inflammation, and treating muscular strain. The active compound found in *P. americana* is said to compare to cortisone. *Achillea millefolium* has multiple chemicals that result in medicinal uses. The most notable is azulene, which is aids in treating inflammations, overexerted joints and muscles, and cramps.

JUDITH URBANIC*, MARTENEY JACOBS*, and ALAN M. DANIEL, Department of Behavioral Sciences, Glenville State College, Glenville, WV 26351. **An inexpensive, automated apparatus for measuring consummatory behavior in restrained honey bees.**

The honey bee has been established as a useful model for understanding a wide variety of cognitive tasks and learning situations. The most common neuroscience techniques rely upon a single type of behavior, the Proboscis Extension Response (PER). However, evidence from mammalian studies suggest the PER may not be sensitive to some learning phenomena, and may not capture important aspects of behavior.

Another potential behavior that can be measured within the same paradigms as PER is consummatory behavior. To measure consumption of sucrose, a lickometer was created by wiring the bee harnesses and the sucrose delivery probe to a computer. When the bee proboscis contacts the probe, a circuit is completed and the computer can measure lick time for each trial. This data is collected automatically in conjunction with normal PER data using the standard training procedure.

Potential applications will be discussed, supported by data from our lab. Consummatory behavior complements the instrumental behavior observed in PER, and may serve as a useful tool to distinguish between the underlying mechanisms of these two classes of behavior.

TIFANY WOODSON*, MARK FLOOD and DONALD TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont State University, Fairmont, WV 26554. **The comparative allelopathic effects of invasive plants on *Lactuca sativa.***

Allelopathy is an organism's ability to produce one or more biochemicals that influence the growth, survival, and reproduction of other species. Some invasive exotic plants may be more successful at invading and dominating natural areas because of the use of allelopathic compounds. In order to compare the potential allelopathic effects that invasive species might exhibit, we tested the extracts of winter twigs (50 g) soaked in water (500 mL) on the germination and growth of *Lactuca sativa* seeds (lettuce). The invasive species included *Ailanthus altissima* (tree of heaven), *Elaeagnus umbellata* (autumn olive), *Lonicera tatarica* (honeysuckle), and *Paulownia tomentosa* (princess tree).

There were six treatments: one for each of the invasive species, one control with *Juglans nigra* (black walnut), and a water control. Three replicates of six treatments were set up in petri dishes containing filter paper moistened with extracts, and two rows of ten lettuce seeds each.

After seven days, lettuce seeds were examined for signs of germination. Roots and shoots, if present, were measured and recorded. The tree of heaven had the most negative allelopathic effect on the lettuce seeds, as 11.6% did not germinate. These seedlings had very tiny roots with an average length of 0.711 cm, but no shoots had developed. Autumn olive had the next most negative effect, with roots averaging 3.47 cm and shoots starting to expand. The princess tree had the most beneficial effect of the invasive species, seemingly promoting germination and development, with roots averaging 4.77 cm.

COMPUTER SCIENCE

CHAD VANORSDALE*, WEIDONG LIAO and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **Firefox OS: a comparative analysis of web apps.**

Native apps continue to be allowed access to device APIs, while the mobile web is denied this privilege. This is solved in part by hybrid apps that combine the capabilities of web apps and native apps. However, performance and usability can become an issue. As a result, Mozilla has created Firefox OS which aims to give web apps the same access as native apps and create a native experience using only web technologies. Our research studies how the current two major mobile operating systems, iOS and Android, provide web apps to the users. It then studies the upcoming web-based mobile operating system from Mozilla, Firefox OS, to see how it provides access to web apps. We compare and contrast the benefits and performance of these different platforms through benchmarking, and by creating and analyzing applications ourselves.

HENRY WARE, MModal, Inc. Morgantown, WV 26505; JOHN ATKINS and RAYMOND MOREHEAD, Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV 26506. **A note on second normal form.**

Third Normal Form has been considered the *de facto* standard in the design of relational databases. Bernstein showed that any relation schema not in Third Normal Form can be losslessly decomposed to subschemas in Third Normal Form while preserving functional dependencies. Furthermore, any relational schema can be evaluated for conformance to Third Normal Form in polynomial time (given that the keys are known). Since every relation schema in Third Normal Form is in Second Normal Form, and since Third Normal Form is the generally accepted goal in database design, the study of Second Normal Form has been somewhat neglected. Exacerbating this neglect has been the absence of a convenient method to determine conformance to Second Normal Form (given that the keys are known). This paper attempts to rectify that deficiency. Given the keys for the relation schema, we explore a polynomial time algorithm to decide definitively if a relation schema is or is not in Second Normal Form.

ECOLOGY

SPENCER BELL* and ZACHARY J. LOUGHMAN, Department of Natural Science and Mathematics, West Liberty University, West Liberty, WV 26074. **Life history of *Orconectes obscurus* in northern West Virginia.**

Orconectes obscurus is common in West Virginia's northern and eastern panhandles and the greater Monongahela River system. Though common in West Virginia, *O. obscurus is* protected in neighboring Ohio and Maryland, and susceptible to eradication by invasive crayfishes. Understanding *O. obscurus* life history where it is not imperiled will assist conservation actions directed toward imperiled populations. Seasonal life history parameters were determined for *O. obscurus* in North Fork and Short Creeks, Ohio County, West Virginia, monthly from March 2012 through April 2013. Reproductive and molt states along with morphometrics were recorded for all individuals encountered. All ovigerous females were vouchered to determine egg/instar

compliments. Each month, 10-20 non-ovigerous females were dissected to determine monthly gonadic development. Form state frequency for males was determined monthly. Age histograms were created each month from total carapace lengths, and dominant size cohorts noted. Results indicated that at least four size cohorts were present within both populations monthly. Males enter winter aestivation as form I and molt to form II by the end of May, and molt back to form I in late July. Female egg compliment was positively correlated to total carapace length ($r^2 = 0.87$). Females deposited eggs beginning in late March and maintained instars through the end of May. Young of the year entered the population in late May and were capable of reproducing the following fall. Results of this study indicate that *O. obscurus* in northern West Virginia likely have a two-year life span.

JESSICA CHANEY*, Department of Chemistry, Shepherd University, Shepherdstown, WV, 25443, and CAROL Z. PLAUTZ, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **The link between disturbances in reproduction and expression of enzymes in the steroidogenic pathway in aquatic invertebrates exposed to components of the herbicide Roundup.**

Roundup is a common herbicide in agriculture; as a water-soluble compound, the chemical washes into the local watershed. Its effects on aquatic wildlife are largely unknown but of great interest to many disciplines. *Lymnaea palustris,* the pond snail, is a common mollusk that is an ideal model to detect Roundup's effects on organisms. One aspect of snail physiology subject to disruption by Roundup is reproduction. This study focuses on the effects that Roundup and its components have on the expression of Steroid Acute Regulatory Protein (StAR), the essential rate limiting step in sex hormone production. A disruption in the abundance of StAR will lead to a decrease in the production of sex hormones. This could be linked to the reproductive decrease observed in snails chronically treated with Roundup and its components in our lab (Mines 2013). Snails were chronically treated to determine which component resulted in the greatest decrease in StAR expression. Total snail protein was isolated and analyzed for StAR expression by SDS-PAGE and Western blot.

Results indicate that Roundup has a detrimental effect on the expression of StAR. The abundance of StAR was depressed an average of 80% by Roundup, 50% by glyphosate, 90% by diquat dibromide, 85% by POEA, and 90% by glyphosate plus POEA. StAR is present in the molluscan brain, kidney, and ovotestis. The expression of StAR was depressed substantially but differentially in the ovotestis (95%), brain (80%), and kidney (45%).

This work was supported by a SURE grant for STEM undergraduate research in West Virginia.

RAQUEL FAGUNDO*, EVAN LAU, E. JOSEPH NOLAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074; ROGER THOMA, Midwest Biodiversity Institute, Columbus, OH 43221-0561; ZACHARY J. LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Taxonomic standing of *Cambarus sciotensis* (Teays River crayfish) in West Virginia.**

Cambarus sciotensis and *Cambarus angularis* are morphologically similar crayfishes, with *C. sciotensis* occurring in the Scioto, New, and Gauley River basins, and *C. angularis* occurring in the Greater Tennessee River basin. The New and Gauley River systems of Virginia and West Virginia are known to contain populations of *C. sciotensis* that are morphologically distinct from the type population found in the Scioto River in Ohio. Survey efforts in 2009 discovered a new isolated population of *C. sciotensis* in West Virginia's Tug Fork (which neighbors the New and Clinch River basins) and these crayfish also appear morphologically distinct. To determine the taxonomic status of West Virginia populations, maximum likelihood phylogenetic analyses

were performed on a dataset of cytochrome oxidase I (COI) sequences in order to compare Tug Fork and New River C. sciotensis to the type populations of both C. sciotensis and C. angularis. The resulting tree supports the Tug Fork (99%) and New River (71%) *C. sciotensis* populations as evolutionary significant units, but they were not distinct enough (< 5.0%) to be considered separate species. Morphologically, several characters have been identified that can differentiate each population, which only adds to the taxonomic confusion surrounding populations of *C. sciotensis* in West Virginia. Interestingly, the New River population was most closely related to the Scioto River population than to the geographically proximal Tug Fork population. This result lends further support to the hypothesis that C. sciotensis evolved in the pre-glacial Teays River prior to its invasion of the Scioto and New Rivers.

DAVID FOLTZ II*, THOMAS JONES, Integrated Science and Technologies Department, Marshall University, One John Marshall Drive, Huntington WV 25755; ZACHARY LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074-029. **Morphometric and reproductive analysis of Cambarus cf. robustus, a newly described species of Cambarid crayfish from the Twelvepole watershed in West Virginia.**

Crayfish are the third most endangered faunal group in the world, behind freshwater snails and unionid mussels. A better understanding of each species' life history is vital to aid in conservation of these organisms; however, little to no information is available for many of these species. Recently, a new species of Cambarid crayfish, *Cambarus cf. robustus,* was discovered in the Cumberland Mountains of West Virginia and Eastern Kentucky. In conjunction with scientific description of *C. cf. robustus,* life history data for the species will be collected from May 2012 through April 2013 from two sites located within the Twelvepole watershed. Thirty seine haul samples per site are taken monthly, and all crayfish are identified to species level, measured for their TCL or total carapace length, and released. Mature females showed signs of glare in May. Egg extrusion was noted in early June, with instars occurring July through August, before becoming free living juveniles. Mature female TCL in this study ranged from 27.9-52.9 mm. Form I males were collected throughout the year, but reached their highest densities during May through August. Form I male TCL in this study ranged from 30.6-50.6 mm. Histograms showing TCL length in relation to number of crayfish collected place estimated life expectancy of *C. cf. robustus* at five years. Older individuals of both sexes were found dead with no evidence of predation after reproductive responsibilities were met, during August for males and October for females, indicating reproductive events are taxing on both males and females.

LAUREN GATES* and MARK FLOOD, Department of Biology, Chemistry and Geoscience, Fairmont State University, Fairmont, WV 26554. **Determination of the effects of Marcellus shale drilling and fracking on local stream composition.**

Marcellus shale drilling is rapidly growing nationwide. However, recent reports have shown several issues in water quality from the hydraulic fracturing process. This study was conducted to examine whether or not drilling and hydraulic fracturing processes that are performed in West Virginia negatively impacted water quality in streams located near well sites. Nitrate, phosphate, total dissolved solids (TDS), pH, temperature, conductivity, and turbidity were measured above and below different Marcellus well sites to determine water quality. Macroinvertebrates were also sampled at these sites to evaluate the impact Marcellus drilling and fracking activities had on the aquatic ecosystem. Several factors in the streams were affected by the presence of the wells, such as decreases in the Family Biotic Index and Taxa Richness were noted below well sites. In addition, increases in turbidity, TDS and amount of phosphate were observed below

well sites. In conclusion, several factors in the streams appear to be affected by the presence of Marcellus shale wells, and long term monitoring is needed to ensure a safe drinking water supply and healthy stream ecosystem.

This project was supported by a Fairmont State University SURE grant.

JENNIFER GOGGINS* and MARK FLOOD, Department of Biology, Chemistry and Geoscience , and JONATHAN ADAMS, Exercise Science, Fairmont State University, Fairmont, WV 26554. **Determining the effect of thalidomide on Bullfrog tadpole development.**

Thalidomide was introduced in the 1950s to treat morning sickness, but was withdrawn from the market because of teratogenic properties. Thalidomide has more recently been used to treat cancer, with the main mechanism being angiogenesis inhibition, and leprosy. Research is investigating the treatment of autoimmune conditions, although its use is controversial. The hypothesis of this experiment was that the higher amounts of thalidomide would result in slower tadpole growth and cause more defects, abnormalities, and deaths. For this experiment, mortality, length, and weight measurements were collected from tadpoles exposed to thalidomide (100 mg/mL) at 0 µL, 1 µL, 10 µL, 100 µL, and 400 µL doses per 1 L of tap water for a two-week time period. The data showed that the control group lost 33% weight on average, while all other groups had less of a loss and the highest dosage group gained about 20%. Also, the control had an average length loss of about 18%, while all thalidomide exposed tadpoles had increases in length. The highest thalidomide dosage had the most fatalities (50%), then the control group (33%), and all others had lower death rates. The high mortality rate for control group was likely caused by a contracted fungal infection. In conclusion, the highest dosage of thalidomide led to the most growth, but resulted in an increase in mortality as well as other developmental effects.

MICHELE GROVES* and MARK FLOOD, Department of Biology, Chemistry, and Geoscience, Fairmont State University, Fairmont, WV 26554. **Determining the long-term and short-term effects of nonylphenol on *Daphnia magna.***

Nonylphenol is an organic compound found in solutions used in hydraulic fracturing, a process commonly known as fracking. The chemicals and water that were pumped into the rock during fracking are also pumped back out. Some companies have improperly disposed of the wastewater by dumping it directly into the streams, lakes, and rivers causing a severe risk to the environment. *Daphnia magna* was the model organism that used to evaluate the effects of nonylphenol on aquatic animals. The hypothesis was that *Daphnia magna's* reproductive rate would decrease along with more noted altered behavioral activity with increasing concentration of nonylphenol. For the long-term study, nonylphenol was administered at five concentrations: 0 µM, 0.425 µM, 0.850 µM, 1.25 µM, and 1.70 µM for a three week time period. *Daphnia* (10/treatment) were monitored for behavioral and reproductive effects. *Daphnia* in the 1.70 µM nonylphenol had the largest decrease in reproductive rate and had the largest decrease in awareness and activity, along with a color change to almost completely translucent. Lower concentrations caused little-to-no reproductive or behavioral effects. For the short-term study, *Daphnia* were exposed to the five concentrations for one hour and heart rates were measured. The brief exposure to nonylphenol caused a very irregular and decreased heart rate, compared to the control. The initial data collected in this project suggests that nonylphenol has a detrimental effect on aquatic organisms, and that further study is needed to elucidate a more detailed mechanism.

BENJAMIN HACKETT* and CAROL Z. PLAUTZ, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Investigating the cellular basis of long-term**

memory formation and disruption in the pond snail, *Lymnaea palustris.*

The small freshwater mollusk *Lymnaea* is a model system for molecular analysis of learning and memory. Long-term memory has been shown to up-regulate the expression/activation of protein kinase C (PKC). Previous studies in our lab have concluded that this up-regulation is disrupted by the common herbicide Roundup, which can find its way into aquatic systems where animals such as *Lymnaea palustris* are found. Possible mechanisms for how PKC is down-regulated by Roundup are being tested in this study. Microtubules and actin filaments are structural elements within cells that also aid in transport of cellular and extracellular molecules. These structural proteins are known to play a role in the regulation of PKC, among other molecules. Colchicine and cytochalasin D were used to disrupt the microtubules and actin filaments respectively in order to specify if either or any of these proteins were incorporated in the transport mechanism used by PKC. Chelerythrine chloride (a PKC inhibitor) was tested against Roundup concentrate to compare PKC levels. Learning and memory tests were performed on all snails to determine if the alteration of PKC levels had a behavioral effect. These experiments should help to elucidate the formation and disruption of long-term memory in this invertebrate model.

JESSICA HARVEY* and KIMBERLY A. BJORGO-THORNE, Department of Biology and Environmental Science, West Virginia Wesleyan College, Buckhannon, WV 26201. **Cattle excretions affect nitrate loading within nutrient-poor streams in Upshur County, WV.**

The U.S. Environmental Protection Agency limit for nitrate (NO3-N) concentrations in streams is 10 mg/L. High nitrate levels can cause methemoglobinemia in infants. Farm waste is a major source of nitrogen-containing compounds that contaminate water sources. We sought to examine the use of high pressure liquid chromatography (HPLC) to detect nitrates in both cattle excretions and in environmental samples following the methodology of Schroeder (1987). Our results indicate that HPLC is effective at detecting concentrations above 1 mg/L. However, HPLC was not effective at concentrations less than 1 ppm. We were able to build a calibration curve for 1-25 mg/L with an R2 value of 0.8734. We were able to reliably estimate the NO3-N concentration in cattle feces, urine, and feed samples. We were also able to determine NO3-N levels in local streams adjacent to cattle operations. This data can be used by water managers to evaluate nitrogen loading in the Upshur County area from cattle contributions.

Support was provided for this research from the SURE grant awarded to West Virginia Wesleyan College by the WVEPSCoR program.

JUSTIN HILLIARD* and PHILLIP YEAGER, Department of Biology, Chemistry, and Geoscience, Fairmont State University, Fairmont, WV 26554. **Microbial community ecology of the West Fork River**.

We hypothesized that there are differences between the microbial communities within the West Fork River, and that these differences are driven by heavier loading of sediment during rain events. Ten sites were chosen along the West Fork River between Hepzibah, WV and Fairmont, WV. Microbial community profiles were assessed with Biolog EcoPlates. Various chemical and physical parameters were determined in the field and laboratory.

An alpha value of 0.05 was used to assess statistical significance. The reactive phosphorus data was subjected to an ANOVA; a *p*-value of 1.97E-7 supports significant variation between the sampling sites. The total phosphorus data was subjected to a Kruskal-Wallis test; a *p*-value of 0.010 supports significant variation. Hierarchical cluster analyses were performed on the data in various combinations. The resulting dendrograms revealed that the section of the West Fork River assessed can be divided into two structurally and functionally different regions, the amount of available phosphorus in the water

column decreases toward the mouth of the river, and nitrate seemed to be the dominating nutrient with regard to the clustering patterns observed. Only single measurements were collected for nitrate, preventing any statistical tests for variance. We were not able to test our hypothesis due to dry weather. This study can serve as a preliminary framework for further and more extensive study.

A SURE grant from Fairmont State University supported this project.

CLAIRE JUSZCZAK*, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV; ZACHARY LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV. **Results of the first butterfly survey of Hancock County, West Virginia.**

Butterfly distributions are well understood in West Virginia, compared to other invertebrate groups occurring in the state. However, Hancock Counties' butterfly fauna are poorly understood, and remain a major gap in the knowledge of West Virginia's butterflies. To rectify this issue, a survey of Hancock Counties butterfly fauna was completed in 2012. Fifteen randomly chosen locations were sampled with aerial nets mid-month from May through October, for one to two hours. All captured butterflies were vouchered and identified in the laboratory. Twenty nine species of butterflies from 14 families were recorded for the county resulting in 21 county records. Forest edges and old fields produced the highest diversity. Introduced Cabbage whites were the most frequently encountered species. American snout, American lady, and Variegated fritillaries were only collected once. The diversity of Hancock County's butterfly fauna is consistent with other counties in the Appalachian Plateau.

ZACHARY J. LOUGHMAN, Department of Natural Science and Mathematics, West Liberty University, West Liberty, WV 26074. Should I stay or should I go? **Determining the movement patterns of male New River crayfish through use of radio telemetry.**

To better understand the daily activity and macrohabitat preference of male *Cambarus chasmodactylus* (New River crayfish), a study was performed in Anthony Creek, West Virginia, utilizing radio telemetry. Nine 0.8 g transmitters were fitted to the chelae of *C. chasmodactylus* (6 IM/3 IIM) which were released at their initial point of capture. Animals were tracked for five consecutive days, after which a 20-day noninteraction period was initiated, followed by six additional days of tracking. Upon location of each individual, water depth, current velocity, substrate type, and distance travelled over the previous 24 h were noted. The Robinson *et al.* (2000) ephemeral home range concept was applied to the majority of movement patterns, indicating individual *C. chasmodactylus* have multiple home ranges over the course of their lives. Beginning in July, Form I males maintained more permanent territories under slab boulders, which was theorized to be behaviorally-mediated by reproductive receptivity of females. Smaller males moved longer distances and more frequently than larger adults. Macrohabitats preferred by *C. chasmodactylus* were allied with moderate depths and velocities and the presence of slab boulders. Adult *C. chasmodactylus* appear to be habitat specialists that utilize slab boulders exclusively as daily retreats. Results from this study exhibit the utility of telemetry as a means to determine macrohabitat and basic ecological data on crayfishes, which currently is lacking for this group of animals.

SAMANTHA MINES* and CAROL Z. PLAUTZ, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Investigating reproductive and developmental abnormalities in the aquatic invertebrate Lymnaea palustris exposed to components of the herbicide Roundup.**

The presence of herbicides is a danger to non-target species that live in freshwater

habitats. Roundup, a weed-killer, may reach such habitats by run-off, drainage, or aerial drift, and is highly worrisome to ecotoxicologists due to its high water solubility and widespread usage in the environment. Diquat dibromide (DD), a component of Roundup, was tested on the gastropod *Lymnaea palustris.* Roundup and DD were tested for effects on snail mortality and reproductive output, or fecundity, in terms of number of jelly masses laid and number of embryos per jelly masses laid, and developmental abnormalities of offspring in chronic toxicity treatments. The effects of acute treatments of Roundup, DD, POEA, glyphosate, and combination solutions were also tested on *L. palustris* embryos.

In the adult chronic treatments, the mortality of the snails was not observed to be affected significantly by Roundup or DD. At the same concentrations, however, the number of jelly masses laid differed significantly from controls; the number of embryos per jelly mass in Roundup and DD were observed to differ significantly from expected values as well. The acute treatment of *L. palustris* embryos caused abnormalities such as blebbing, dissociation, and retarded growth. Embryos in DD treatment were observed to exhibit the highest amount of abnormality compared to other solutions and combination solutions. Further research will focus on the mechanisms of embryonic development perturbed by DD.

This work was supported by a SURE Grant for STEM undergraduate research in West Virginia.

ENGINEERING

JAMEST. ANDERSON, West Virginia University, Environmental Research Center, PO Box 6125, Morgantown, WV 26506; JONATHAN L. PITCHFORD, The Institute for Marine Mammal Studies, Gulfport, MS 39502; STEPHEN M. SELEGO, Division of Forestry and Natural Resources, West Virginia University, KATHRYN R. P. McCOARD, West Virginia University, Division of Forestry and Natural Resources, Morgantown, WV 26506; LIANSHIN LIN, West Virginia University, Department of Civil and Environmental Engineering, Morgantown, WV 26506; GEORGE T. MEROVICH, Jr., West Virginia University, Division of Forestry and Natural Resources, Morgantown, WV 26506; STUART A. WELSH, West Virginia University, Cooperative Fish and Wildlife Research Unit, Morgantown, WV 26506. **Biotic and abiotic response to stream restoration on the Cacapon River.**

Numerous stream banks within the Chesapeake Bay watershed are unstable and contributing to sediment, phosphorus, and nitrogen deposition in the Bay. We evaluated impacts of natural stream design (NSD) practices implemented on the Cacapon River on aquatic and riparian life, erosion, and water quality along a 1,100 m restoration reach and nearby control and reference reaches from 2009 – 2012. We found positive changes in stream morphology, non-point source pollution, and riparian buffer conditions following stream restoration. Changes in channel morphology varied within and across study reaches during the study period. Mass balance calculations indicated that sediment and nutrient loss decreased dramatically following restoration. Continuous turbidity monitoring above and below the restoration reach during active construction indicated that the reach was a large source of sediment during this time. However, monitoring a year after construction was completed revealed similar turbidity readings above and below the restoration reach. One year following completion of restoration, the average abundance and diversity of woody vegetation was higher than control and reference reaches. Small mammal and anuran metrics varied little among reaches, but overall bird abundance, richness, and diversity were higher in the restoration reach compared to controls. Stream invertebrate metrics at the restoration reach resembled a control reach before restoration, but resembled a reference reach after restoration. The Daniels fish index of biotic integrity successfully differentiated the control and reference reaches and indicated a shift from the former to the latter

in the restoration reach post-impact. Overall, NSD techniques improved short-term biotic and abiotic characteristics.

NICHOLAS L. HILLEN** and JOHN M. KUHLMAN, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506. **Single impinging droplets on a preexisting liquid surface using high-speed video imaging visualization techniques for bottom cavity size.**

As electrical components advance, device size and resulting surface area decreases, so heat flux increases requiring active cooling techniques. Spray cooling is a promising advanced heat removal technique capable heat fluxes up to 500 W/cm2 with water as the coolant. The West Virginia University Spray Cooling team is improving a Monte-Carlo based spray cooling model that will be a cost effective design tool that will use empirical correlations to accurately predict heat flux based on nozzle properties and heater geometry. To improve the model, the sub-cavity liquid volume created by impinging drop is needed since it is key in determining cavity dryout. Single drops experiments have been performed to measure the cavity liquid film thickness at different cavity radial locations, which are then integrated to determine the sub-cavity volume. To accurately traverse the cavity, its radius must be known. High-speed video, viewing the droplet impacts from beneath the impact surface, was used to determine cavity radius versus time. This was accomplished by using a transparent impact surface, and various mirror and lighting alignments. Custom Matlab based image processing software has been developed to track the radius of the bottom cavity versus time. Two main configurations were developed using back lighting and front lighting, respectively. The back lighting provided superior contrast for more robust image processing, but proved impractical. Therefore, the front lighting setup was chosen, and the image processing code was optimized for the resulting lower contrast video.

This work is supported by NASA Cooperative Agreement NNX10AN0YA.

MAHMOOD HOSSAIN, Department of Computer Science, Fairmont State University, Fairmont, WV 26554, TADASHI KATO, Department of Behavioral, Fairmont State University, Fairmont, WV 26554, and MICHAEL SINK, Department of Computer Science, Fairmont State University, Fairmont, WV 26554. **Frequency spectrum analysis of multichannel EEG using auditory stimuli of varying fractal dimensions.**

The psychophysiological effects of music can be quantitatively studied using Electroencephalogram (EEG). EEG refers to the electrical activity of the brain neurons captured from scalp surface. The purpose of this work was to examine the psychophysiological effects of various diatonic scales using fractal dimensions and frequency spectrum. In particular, we tried to discover which music modes trigger particular frequency ranges of brain activity. Our data collection involved healthy adult subjects being exposed to synthetic music pieces with varying degrees of randomness, and multichannel EEGs being measured. All music pieces were composed in natural minor mode with three different pitches of electronic piano sound in 8 beats, 16 beats, and 32 beats, respectively. We computed fractal dimensions of the EEG signals and also converted the time-series EEG data into frequency domain using Discrete Fourier Transformation (DFT). We calculated the peak alpha frequency (PAF) and peak beta frequency (PBF) from the frequency spectrum of the EEG signals. The alpha frequency band (8-12 Hz) and beta frequency band (13-30 Hz) are known to be associated with the relaxed and active states of the brain. We performed association mining between the EEG fractal dimensions and the corresponding peak alpha and beta frequencies. We found some strong associations between the EEG signal complexity and peak frequencies in EEG.

ANVEEKSH KONERU**, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26505, and TERENCE MUSHO, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26505. **Computational predictions of thermoelectric properties of cobalt spinels using *ab initio* methods.**

There has been a recent interest in developing oxide thermoelectric materials for their capability to enhance conversion of thermal energy to electricity. The objective of this research was to theoretically evaluate the thermoelectric properties of oxide materials for their candidacy in direct energy conversion devices. First principle density functional theory calculations were implemented to predict the ground state properties of three cobalt containing oxides: Co3O4, Co2NiO4 and Co2ZnO4. These ground state results were then used in a quantum model to calculate the transport properties. The transport properties of interest include the Seebeck coefficient, electrical conductivity, and thermal conductivity. Incorporating the transport results into a figure of merit allowed a metric to be calculated that could be used to gauge the performance of each of the oxides. These results also provided insight into intermediate compositions which bear optimal thermoelectric properties. Ultimately, the computational framework developed provides a generic method for evaluating more complex compositions with more expanse design spaces. Future research will investigate the micro-structural influences on thermoelectric performance and allow optimization of both composition and microstructure.

STEVEN MCCLELLAND** and JOHN ZANIEWSKI, Department of Civil and Environmental Engineering, Statler College of Engineering and Mineral Resources, West Virginia University, P.O. Box 6103, Morgantown, West Virginia 26506-6103. **The West Virginia contribution to America's first asphalt roads.**

Numerous stories relate that asphalt from Ritchie Mines in West Virginia were used to build early asphalt streets in America. One of the earliest was Fifth Avenue between Twenty-fourth and Twenty-fifth streets on Manhattan. It was started in 1872 and completed in 1873 by the Grahamite Asphalt Paving Company. Considered the father of asphalt paving as we know it today, Belgian immigrant Edward de Smedt was familiar with European asphalt practice. De Smedt was awarded a US patent in May 1870 for mixing sand, gravel, asphalt and heating the mixture. Just before it was laid down, a small amount of "Ritchie mineral" (renamed Grahamite for the Graham brothers of New York City) or Albertite (from New Brunswick) was added to allow the pavement to withstand the summer heat. Since the contractor was the Grahamite Asphalt Paving Company, the West Virginia asphalt mine's owner at that time, West Virginia material probably was used to change the properties of the Fifth Avenue project asphalt binder. Perhaps the most interesting aspect of this project is the modification of the softer, cheaper Trinidad Lake asphalt with grahamite to yield a satisfactory pavement. The behavior of modified asphalt is a current research topic since it was not addressed by the current Superpave PG asphalt specifications. This project using de Smedt's 1870 patent must be one of the first examples of a modified binder. West Virginia's contribution, largely ignored by the asphalt industry's perception of its history, was the binder modifier.

LYNDSAY RANKIN** and ANNE AXEL, Department of Biological Sciences, Marshall University, Huntington, WV 25755. **Assessment of landscape degradation using Landsat images and vegetation sampling in southern Madagascar.**

The dry forests of southern Madagascar contain varied forest types (gallery, dry deciduous and spiny thicket), possess the country's highest plant species endemism (95%), and are experiencing faster deforestation than that of Malagasy rainforests. Human-influenced

habitat degradation impairs ecological integrity through fragmentation. Dry forests are utilized for agriculture, forest product extraction, and livestock grazing resulting in widespread degradation of variable condition. The goal of this study is to determine if ground-level forest condition is correlated to Landsat satellite imagery. A decision tree classifier was used to classify the study area into three forest classes (gallery, dry deciduous and spiny thicket, and non-forest). Environmental variables (e.g., tree and seedling species richness and diversity, basal area, canopy cover, and soil hardness) were collected on the ground in 2010. Vegetation indices that highlight differences in forest condition were calculated using 2020 dry and wet season satellite imagery. Indices include: moving standard deviation index (MDSI) to classify textural differences, modified soil-adjusted vegetation index (MSAVI2) which may be a better measure of vegetation in semi-arid environments than NDVI, and tasseled cap transformation (wetness, greenness, and brightness) to quantify forest biomass. Hierarchical cluster analysis was performed on environmental variables to classify sampling plots into disturbance level groups by forest type. Using ground-level data as training data, a random forest classifier was used on satellite data to classify disturbance types. Remotely-sensed classifications were compared to ground-level disturbance clusters to determine if medium resolution satellite data could detect differences in forest condition in a human-disturbed landscape.

MICHAEL SNYDER** and LESLIE HOPKINSON, Department of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. **The hydrologic response of valley fills with alternative reclamation methods.**

Current surface mining reclamation procedures rely upon the construction of valley fills to contain the displaced overburden. Traditional valley fill designs incorporate uniform slopes and drainage ditches, but are often susceptible to erosion. Geomorphic landform design attempts to reduce the effects of erosion by constructing landforms in erosional equilibrium. This study aims to analyze the hydrologic impact of redesigned valley fills that use geomorphic landform design principles. Specifically, the hydrologic response of a valley fill under construction in southern West Virginia was compared to a conceptual, redesigned fill, as well as to the un-mined topography. All modeling was completed using Aquaveo Watershed Modeling System 9.0. Stormresponse hydrographs and runoff were calculated for multiple storm events (2-, 25-, and 100-year) for the original topography. The traditional valley fill and redesigned valley fill were analyzed using the same procedure. Preliminary results indicate that the hydrologic response of the redesigned valley fill during a 25-year, 24-hour storm closely resembles the hydrologic response of the original topography. The peak flow rates and runoff volumes differ by less than 10%. Further work will involve analyzing the hydrologic response of the traditional valley fill site as well as additional geomorphic landform designs to a 25-year 24-hour rainfall event.

JONATHAN TAUB**, EDWARD M. SABOLSKY and THOMAS EVANS, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV. **Design, fabrication and characterization of a Surface Acoustic Wave sensor based on PZT thin film for the detection of hypergolic fuels during satellite refueling in the GEO stationary orbit.**

In satellite refueling operations, the detection of fuel leaks during the procedure is a critical assessment to the overall success of the operation. The environmental conditions in the range of 10-7 Torr and -80 ˚C of the GEO stationary orbit, as well as the limiting power, size, weight and data processing conditions due to the robotic system, narrowed the selection of possible sensor for this particular application. Surface Acoustic sensors utilize an interdigitated transducer (IDT) to convert electrical energy into

an acoustic wave. The acoustic wave then travels across the surface of the device to another IDT, converting the wave back into electrical signal. When a leakage occurs and impacts the surface of the device, there will be an alteration in the output electrical (phase shift, frequency shift or time delay). This method provides a sensitive, low power consumption sensor capable of detecting changes in its surroundings. This work describes the fabrication and characterization of a the entire SAW sensor with a PZT as the piezoelectric material, and a novel approach to increase its sensitivity by adding a diaphragm to its design.

J. STEPHEN TAYLOR** and JOHN M. KUHLMAN, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506. **Experiments used to improve and validate Monte-Carlo simulation spray cooling model.**

Development of spray cooling continues because of its ability to remove large amounts of waste heat from electronics. A simple simulation model is necessary to aid in the design of spray cooling systems. A promising model is being developed at WVU using a Monte-Carlo (MC) statistical approach, which will use both experimental and Computational Fluid Dynamics simulation results to predict spray droplet impact behavior on a heated surface. Results for several experimental cases are presented: 1) Phase Doppler Particle Analyzer (PDPA) data for a flat spray nozzle's profile using water as the medium; and 2) heat flux measurements for a heated copper core apparatus undergoing spray cooling, using a full-cone nozzle, again with water as the cooling medium. For the first experiment, profiles of droplet diameter and velocity were determined for a 65 degree Spraying Systems flat spray nozzle using a TSI PDPA system. Profiles were obtained for operating pressures of 2.75 bar and 4.14 bar at a 3.81 cm standoff distance from the nozzle tip. In the second experiment, an oxygen-free copper heater core heated with cartridge heaters and insulated by Teflon was used to determine the heat flux through a heated surface experiencing spray cooling. Thermocouples were used to measure the temperatures of the exposed surface, coolant reservoir, and four different depths along the centerline of the core to determine the heat flux through the centerline of the copper surface. The PDPA data will be used to give a more accurate range of droplet sizes, velocities, and distributions for use within the MC spray cooling model. The second experiment will be used in validation efforts for the updated MC model.

This work is supported by NASA Cooperative Agreement NNX10AN0YA.

TIMOTHY WEADON**, EDWARD M. SABOLSKY, and THOMAS EVANS, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV. **Strategic design of a 0:3 ceramic:polymer composite capacitive sensor array for haptic feedback in robotic space servicing applications.**

The application of polymer-based tactile sensor arrays is limited by an inability to resist the effects of harsh environments. This work describes the fabrication and performance of capacitive sensors based on thin film 0:3 composite structures composed of BaTiO3 and Pb(Zr,Ti)O3 particulates dispersed within a space-qualified polymer matrix. The composite sensor was designed to operate within robotic end-effectors in earth orbit while withstanding environmental conditions in the range of 10-7 Torr and -80 to 120 °C. Using Taguchi methods for the experimental design and analytical models for 0:3 dielectric composites, a series of sensor compositions and processing variables was evaluated. Dynamic loading techniques were implemented to test the composite sensor films, and parameters were selected to maximize the slope (and magnitude) of the sensor response, in addition to minimizing the mechanical hysteresis. Sensors were also characterized for their response to cyclic loading and long-term static loading under various temperatures and durations.

MICROBIOLOGY

SAMANATHA BOLYARD*, LINDSEY DODRILL, STEVEN ROOF and DONALD TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont State University, Fairmont, WV 26554. **The effectiveness of plant extracts on the inhibition of bacterial growth.**

This project was designed to screen plant extracts and a few other natural products for potential antibacterial properties. Plants were collected and extracts were prepared by combining approximately 10 g of plant tissue with 100 mL of methyl alcohol, grinding the mixture to a pulp, and filtering the liquid. Extracts were tested for antibacterial activity by measuring zones of growth inhibition using *Escherichia coli, Staphylococcus epidermidis, Bacillus cereus, Staphylococcus aureus* and *Pseudomonas aeruginosa.*

Over 70 plant species, a fungus, and a few products from the honeybee hive were tested. None of the extracts was effective against E. coli. Several extracts (*Lindera benzoin, Tsuga canadensis, Juglans nigra*, and honeybee propolis) were effective against *S. epidermidis,* producing zones of inhibition as large as 19 mm. These same extracts, plus a few more, *(Prunus serotina, Liriodendron tulipifera, and Rosa multiflora)* produced zones of inhibition as large as 24 mm against *B. cereus.* Additional research should be conducted to isolate specific compounds and test against a wider range of bacteria.

This research was supported by Fairmont State University SURE grant.

BRIANNA N. COWAN**, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Genetic modification of *Francisella tularensis* LVS to create a novel vaccine against *Pseudomonas aeruginosa.***

Francisella tularensis LVS is an attenuated bacterium that has been used as a live vaccine for at-risk personnel. Patients immunized with this strain show long-term immunological memory (over 30 years post-vaccination), indicated by a strong cell-mediated immune response and cytokine production. Because *F. tularensis* LVS is such a potent vaccine, we are interested in using this organism as a novel vaccine platform for expressing genes of opportunistic pathogens such as *Pseudomonas aeruginosa.* As *P. aeruginosa* is resistant to many antibiotics, the need for a vaccine is magnified. However, a licensed vaccine against *P. aeruginosa* does not exist. We genetically modified *F. tularensis* LVS to express PilA of *P. aeruginosa* (PilAPa), using molecular tools that we previously developed (yielding the strain, LVS-PilA). Western blotting, using either a mouse monoclonal or rabbit polyclonal antibody targeting PilAPa, showed expression of this protein by LVS-PilA. Since PilA is a protective antigen, immunization with our engineered LVS-PilA strain should provide protection against a *P. aeruginosa* challenge. We are currently carrying out vaccine/ challenge studies in which mice were immunized with LVS-PilA, infected with a lethal dose of *P. aeruginosa,* and then monitored for morbidity and mortality. Additional investigations involve engineering LVS to express other *P. aeruginosa* protective antigens.

KALA DURHAM* and STEVEN ROOF, Department of Biology, Chemistry and Geoscience, Fairmont State University, Fairmont, WV 26554. **Determining the sanitizing capability of the Steri-Pod™**

There are many products on the market that claim sterilization or reduction of bacteria and viruses on such items as tooth brushes that are kept in close proximity to toilets or other sources of contamination. Many of these products have deceptive names or marketing schemes that may fool the average consumer into thinking that the product is more effective than it actually is. This study was conducted to test the antimicrobial activity of the Steri-Pod™ toothbrush sanitizer. Sterile brushes were inoculated with E. coli and

exposed to the effects of the Steri-Pod™ for varying lengths of time. Our data show a 100 to 1000-fold reduction in recoverable bacteria on brushes treated with the Steri-Pod™.

JOSEPH HORZEMPA, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Identification of bacterial factors that mediate erythrocyte invasion by Francisella tularensis.**

Francisella tularensis invades erythrocytes during infection, a finding that was demonstrated previously in the mouse model of tularemia, and *in vitro* using human erythrocytes. Here, we investigated bacterial factors that contribute to this phenomenon. Opsonization of bacteria with polyclonal rabbit serum against *F. tularensis* drastically diminished erythrocyte invasion. This indicated that proteins mediating red blood cell invasion were likely present on the surface of the bacterium. Immunogold transmission electron microscopy revealed that bacterial molecules were translocated into the erythrocytes prior to invasion. Upon deletion of *mglA,* a transcriptional regulator of the type VI secretion system (T6SS) among other genes, bacteria were unable to invade erythrocytes. This result is consistent with the hypothesis that the T6SS mediates erythrocyte invasion. Currently, mutant strains lacking specific T6SS proteins and effectors are being investigated for their ability to invade red blood cells. In addition, we are also comparing the surface proteins of the *mglA* mutant with wild-type bacteria in order to identify other factors necessary for erythrocyte invasion.

PHYSICS

MERIKA KHURANA*, Department of Biology, Shepherd University, Shepherdstown, WV, 25443; JEFFREY GROFF, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Estimating the Boltzmann constant using simulations to fit experiments of settling Brownian particles.**

Brownian motion can be studied by observing one-micron diameter polystyrene spheres in aqueous solution under magnification. Interestingly, the size of these Brownian particles is such that gravitational settling of the spheres can also be observed. Here, we present a method for estimating the Boltzmann constant by fitting experimental data gathered by observing the gravitational settling of polystyrene spheres with simulations of the experimental system. The experimental data consist of the number of polystyrene spheres at specific vertical positions of a well slide as a function of time. The theoretical model simulates the experiment using a one-dimensional advection-diffusion equation. The Boltzmann constant is estimated by carrying out a simulated annealing algorithm. The algorithm treats the Boltzmann constant as a free parameter and searches for the value yielding the best fit to the experimental data. The fit yields typical estimates of the Boltzmann Constant to within 20%.

This work was supported in part by a West Virginia Space Grant Consortium Research Enhancement Award, a West Virginia Space Grant Consortium Undergraduate Research Fellowship, and a Shepherd University SOARS Scholar Award.

TREY KNEPPER*, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Is photovoltaic (PV) energy output more affected by tilt angle or azimuth angle?**

Solar energy is one of the most rapidly-growing alternative energy industries worldwide, because of benefits including but not limited to renewability and cost competitiveness. Finding a solar array's tilt angle (the angle of PV modules relative to a horizontal plane) and azimuth angle (compass direction) that will maximize photovoltaic (PV) energy output is critical economically. PVWatts, an online solar-production estimation program, was used to calculate annual power output (kWh) for each tilt angle from 0° – 45° at each azimuth angle

from 90° to 180° in 10° increments, based on a 17.6 kW system in Martinsburg, WV. Annual power output was graphed for each azimuth angle relating annual power output to tilt angle. An equation was found for each graph by fitting a parabolic trendline. Employing calculus, the optimum tilt angle for each azimuth angle was found. Calculations were then made to determine if PV output was most affected by the tilt angle or azimuth angle of the solar array. The optimum tilt angle increases by successively smaller increments up to 32.27°, as the azimuth angle increases from 90° to 180°. Overall, the average loss of PV energy output due to being +/- 10° from each azimuth's optimum tilt angle was 1.12%. This compared to losses of 1.61% and 1.64%, due to 10° more or less in azimuth angle, respectively. Statistically, however, there is no significant difference. The results suggest PV output is slightly affected by azimuth angle more, and therefore, given more priority when solar energy systems are designed.

PSYCHOLOGY

AMANDA MADURSKI* and JOHN H. HULL, Department of Psychology, Bethany College, Bethany, WV 26032. **Gender stereotyping in Halloween costumes: scary results.**

Thirty-four female and 30 male participants viewed a PowerPoint® presentation containing six pictures of Halloween costumes in each of six different categories: Costumes for females or males, in adult, child, or infant categories. When a picture initially showed someone modeling the costume, that person was removed from the picture, so costume pictures did not show the gender of the person for whom the costume was marketed. Participants rated each picture on three dimensions: Masculine-feminine, passive-active, and interesting-uninteresting. Repeated-measures ANOVAS for each of the three dimensions showed that costumes marketed for females were rated significantly more feminine, passive, and uninteresting than those marketed for males. Costumes marketed for infants were rated significantly most passive, while those for children were rated significantly most feminine. Finally, the only main effect for participant gender was on the interesting-uninteresting dimension; female participants rated costumes overall as less interesting than did male participants. These results confirm and extend previous studies conducted with pictures of children's toys, and suggest strategies for costume and toy makers who might want to alter the gender stereotyping associated with their products.

ALBERT MAGRO, Department of Biology, Fairmont State University, Fairmont, WV 26554. **Hominid evolution and the aesthetic response to fashion and cosmetics.**

Exaggerations in artistic renditions of human form have been known since antiquity. However, no rational has been given as to why artists employ exaggerations in their artworks. The particular evolutionary rationale presented here for the aesthetic appreciation of fashion and cosmetics begins by exploring the evolution of humans and the cohabitation of closely-related species. The anatomical evolution of humans is manifested in the fossils of hominids.

An objective of this presentation is to present an evolutionary argument about the aesthetic experience elicited by exaggerations in artistic renditions of human form, pop culture items, as well as in the use of fashion and cosmetics. The issues are addressed by relating artistic renditions of human form to hominid evolution and evolutionary principles. Artworks of human form, pop culture items, fashionable apparel and cosmetics along with the fossil record of hominids are presented as *a priori* evidence.

An evolutionary process involves selecting a genetic makeup such that upon procreation, it results in a new population possessing altered phenotypic characters such as anatomical, biochemical and emotional changes.

It is proposed that in the creation of artworks of human form and in fashion and cosmetics there is a propensity to accentuate the anatomical

differences between humans and closely-related species. Responding to these anatomical differences is an adaptation that was selected by the fitness bestowed by avoiding mating with closely related species, thus reducing the risk of having sterile offspring or no offspring at all. This term has been coined cross-species avoidance.

SCIENCE EDUCATION

NICHOLAS WILBUR** and MICHELLE WITHERS, Department of Biology, West Virginia University, Morgantown, WV 26506. **Variation in the teaching of evolution in post-secondary education.**

Even though evolution is a fundamental concept of biology taught at both the high school and college levels, a 2012 Gallup Poll showed that only 15% of respondents accepted a scientific explanation for the evolution of humans. As educators, we wish to understand how we can better use our college biology classes to improve the understanding of evolution. In order to address this issue, we need first need to have a clearer picture of how evolution is taught at the college level. Most studies of this nature have focused on evolution instruction in high school, but surprisingly little is known about the scope of evolution education at post-secondary institutions in this country. In this study, we investigated aspects of post-secondary evolution education, such as course content, teaching methods and instructor perspectives/beliefs. We collected this information via an electronic survey distributed to instructors of evolution at a variety of institutions within the United States. A total of 396 participants from a variety of institutions completed the survey, with faculty members from research universities being the primary respondents. Our results indicate that while variation exists in the course content, methods of instruction and perspectives of instructors, evolution instruction is more consistent at the college than at the high school level.

ZOOLOGY

THOMAS K. PAULEY, Department of Biological Sciences, Marshall University, Huntington, WV 25755; BETH ANNE PAULEY, Department of Natural Sciences and Mathematics, University of Charleston, Charleston, WV 25304. **Nests of the Redbacked salamander *(Plethodon cinereus)* in the upland forest of West Virginia.**

We examined approximately 10,470 Redbacked Salamanders from 1976 through 2012 in the upland forest of West Virginia. Of these, 319 were gravid females, which allowed us to collect reproductive data on this species. The number of gravid females peaked in May, with 175 and decreased to 14 in June and eight in July, suggesting that females nest by June or July. The number of gravid females increased to 25 in August, was 65 in September and 32 in October. These late summer and early fall gravid females will nest the ensuing year. During these 36 years, we observed 59 nests. Eleven were found in May, 20 in June, 23 in July, and five in August. Neonates were found in an additional seven nests during August and September, indicating that eggs hatch during these 23 months. The number of eggs per nest ranged from 5 to 14, with an average of 8. This study provides important information on the natural history of this species in West Virginia.

POSTER PRESENTATIONS

(* indicates undergraduate student, ** indicates graduate student)

ASTRONOMY

BRITTANI LOVE and JASON BEST, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Analysis of quasar distributions in the local universe.**

Quasars are among the most luminous objects in the universe, emitting up to 1000 times more energy than the entire Milky Way galaxy.

Because their luminosities make them easy to observe at immense distances, quasars are useful when studying the large-scale structure of the universe. To better understand this structure, we have chosen to study the most recent Sloan Digital Sky Survey Quasar Catalog. This dataset contains over 100,000 quasars and includes properties such as position, redshift (which correlates to distance), and luminosity. Using the pointwise dimension technique, which originates in the mathematics of fractal geometry, we have analyzed the environments of these quasars on numerous scales. We find two relationships between quasar properties and evolution of structure. We first compared the environments of quasars of different luminosities to each other. Most of the differences in those environments are found in the redshift range $1 < z < 2$. For each luminosity range, we then examined how specific environments around quasars evolved as a function of time. We find that the environments of bright quasars evolved in the distant past, while the environments of faint quasars evolved much more recently.

BOTANY

DONALD E. TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont State University, Fairmont, WV 26554; CHRISTOPHER R. HARDY, James C. Parks Herbarium, Department of Biology, Millersville University, Millersville, PA 17551. **The Fairmont State Flora Project on the WikiPlantAtlas©.**

During the fall semester 2012, students enrolled in Advanced Botany (Bio 3312) were given an assignment to document the flora of the Fairmont State campus. We constructed a portal to WikiPlantAtlas© (www.wikiplantatlas.org/fairmont/) through which students could use the Web to enter and map records of at least 10 plants from five different species. The students began by using their mouse to place a pushpin at the approximate location of their plant specimen on the interactive Google-based map of the FSU campus that is employed by WikiPlantAtlas©. In the dialog box that opened, they were required to enter their name, identify the plant, and add descriptions of the plant and its abundance.

A total of 145 specimen records were entered by 11 students, with an average of 12.6 specimens per student (range 10-20). The assignment was worth 50 points, with bonus points possible. The average grade on the assignment was 95.5% (range 83%¬¬ - 107%). There were 30 families, 42 genera, and 55 unique species identified. Cultivated specimens comprised 45.5% of the records and exotic invasives accounted for only 2.7% of the specimens.

This assignment was intended to be the start of a service project to inform the greater Fairmont State community about the plant diversity present on campus and to eventually involve residents from the community as citizen scientists who could contribute to the Atlas in the surrounding area, state, region, and beyond.

AUTUMN WYATT*, DEVON WILLIAMS*, and MARK B. WATSON, Department of Natural Science and Mathematics, University of Charleston, Charleston, WV 25304. **The effect of the biocide triclosan on *Onoclea sensibilis* and *Osmunda claytoniana.***

The purpose of this experiment was to investigate the effects of triclosan on the life cycle of the sensitive fern *(Onoclea sensibilis)* and the interrupted fern *(Osmunda claytoniana)*. Triclosan is an antibacterial agent used in many consumer products. Triclosan can pass through waste water treatment plants, and contaminate rivers and other waterways. Soil can also be contaminated through the use of waste water sludge as fertilizer on agricultural and reclamation land projects. Triclosan has been shown to inhibit seed germination, growth rate, and development in a wide variety of higher plants, including many crop plants (Stevens *et al.* 2009; Cortex et al. 2012). Aquatic algae are particularly sensitive to low levels of triclosan (Franz et al. 2008). The use of ferns in this study is significant because they share a phylogenetic link between algae and higher plants (Pryer 2004). The heteromorphic

life cycle of ferns lends itself to examine the effects of environmental chemicals on different aspects of plant development.

The present study was done to determine if different life stages of ferns are as sensitive to triclosan in the environment as algae or higher plants. Fern spores, gametophytes, spermatazoids and sporophytes were exposed to environmentally-relevant triclosan concentrations. Triclosan inhibited spore germination at levels above 0.012 ug/L. Gametophyte growth was also inhibited when grown on triclosan-treated peat. The motility of fern spermatozoids was inhibited by 13.33 mg/L triclosan after release from gametophytes, while motility was unaffected by 6.67 mg/L triclosan. Unexpectedly, triclosan treatment of soil increased the number of sporophyte shoots produced.

CELL BIOLOGY / GENETICS

LAURONZA HARMON,* ALICE MAGRO and ALBERT MAGRO, Department of Biology, Fairmont State University, Fairmont, WV 26554. **Increase in membrane-bound ADAM 10 and 12 on the surface of apoptotic LN18 cells.**

For a tumor mass to arise the cells within the tumor, it must, in some way, escape apoptosis. Escape can come about through natural mechanisms mediated by receptor tyrosine kinase family members, or inherent defects in the cells' apoptotic mechanisms, or resistance to the patient's immune system. It has been known for some time that metalloproteinases play an important role in the degradation of the extracellular matrix (ECM). However, the basic action of metalloproteinases, which is the cleavage of proteins, has proven sufficiently sophisticated to orchestrate various functions in addition to degradation of the ECM.

We have previously determined that matrix metalloproteinases [MMPs] are secreted when LN18 glioblastoma cells are progressing through apoptosis. We demonstrate here that there are a number of membrane bound A Disintegrin and Metalloproteinases [ADAMs], which increase in density on the surface of the cells proceeding through apoptosis. The presence and increase of the ADAMs on the surface of the LN18 cells was detected by flow cytometry, using mouse monoclonal-anti-ADAMs as primary antibodies. The secondary antibody was goat anti-mouse F(ab)2 conjugated to phycoerythrin.

The long term objective is to delineate the mechanisms of apoptotic glioblastoma cells having the ability to enhance the invasiveness of glioblastoma type brain tumors. What is distinctive about the overall investigation is that secreted and membrane bound metalloproteinase activity increases as the cells progress through apoptosis, and that there may be a synergistic relationship between apoptotic activation of metalloproteinases and the apoptotic enhancement of glioblastoma invasiveness.

MARTENEY JACOBS*, DYLAN TOMBLIN* and RANDY SMITH*, Department of Science and Mathematics, Glenville State College, 200 High Street, Glenville, WV 26351. **Transformation and purification of recombinant DNA from a test plasmid to be applied to protein kinase A for structure-function relationships of Cγ.**

Protein kinases are associated with many physiological functions in the human body. Protein kinases act as molecular switches and initiate numerous signal-transduction cascades in the cell. Cyclin-AMP dependent protein kinase A (PKA) has been extensively studied and used as a model to study structure-function relationships of other protein kinases. Currently, there are four known isoforms of the PKA catalytic subunit: Cα, Cβ, Cγ AND PRKX. Our research focuses on both Cα and Cγ. Isoform Cα has been well characterized in literature, but not much is known about Cγ. Isoform Cα is found ubiquitously among every tissue in the human body, whereas Cγ is only found in the testes of males. These two isoforms are 83% identical, yet the activity of Cγ is significantly lower compared to Cα. Our goal is to develop the techniques and methods to generate

point mutants to help study the structure-function relationship of Cγ. Thus far, we have successfully transformed competent cells with a test plasmid and purified this plasmid through a variety of steps, which include the use of centrifugation and chromatography purification techniques. We are learning methods that will enable us to purify and characterize PKA at Glenville State College. By developing effective methods of purifying Cα using the instrumentation available at Glenville State College, we can further our research of Cγ, to understand its function in the body even at extremely low activities and why it has remained in the testes of humans and primates without being selected against.

REBECCA JENNINGS*, STEPHANIE SINGLETON* and DAVID B. WING, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Characterization of a spontaneous partial revertant of the mutant vestigial wing gene of *Drosophila melanogaster.***

Vestigial-winged Fruit flies from Carolina Biological Sciences harbored a significant population of flies with a more developed wing that resembled a plank. Genetic crosses were done to determine if the new phenotype could be attributed to a partial reversion of the vestigial-wing allele or a mutation to a second gene that interacted with the vestigial-wing gene. Typical vestigial-winged flies and "plank"-winged flies, originally from the same culture, were outcrossed to wild-type flies for five generations, and purebred lines of both mutant flies were established. Like the vestigial mutation, the "plank" mutation proved to be a result of a single gene mutation and recessive to the wild-type gene. Sex-linkage was not observed. Homozygous "plank" mutants displayed a range of phenotypes and had a reduced ability to develop from pupae to adults. A cross between vestigial-winged flies and "plank"-winged flies yielded an F1 generation with one or the other phenotype. There was no genetic complementation; the "plank" phenotype was caused by a recessive allele of the vestigial-wing gene, an allele different from the classic mutant vestigial-wing allele

DARRYL JOHNSON*, Department of Computer Sciences, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443; LOGAN LYDA*, Department of Chemistry, Shepherd University, Shepherdstown, WV 25443; DAVID J. KLINKE, Department of Chemical Engineering, and Department of Microbiology, Immunology and Cell Biology, West Virginia University, Morgantown, WV 26506; ZHIJUN WANG, Department of Computer Sciences, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443; JONATHAN BRAMSON, Department of Pathology and Molecular Medicine, McMaster University, Hamilton, Ontario, Canada L8S 4L8; QING WANG, Department of Computer Sciences, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443; TIMOTHY HOOVER*, BRITTANY POLING*, and BURTON LIDGERDING, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Numerical simulation of a multi-scale tumor growth model by genetic algorithm.**

A multi-scale mathematical model is developed to better understand the role that cytotoxic T cells play in host defense against tumor growth. A genetic algorithm is implemented in a numerical simulator in an effort to search for optimal parameter sets that result in solutions that closely match experimental data. In the genetic algorithm, parameter sets are encoded as chromosomes. In the evolution process, crossover points and the mutation rate can be dynamically adjusted so the algorithm can move more efficiently in the multi-dimensional parameter space, and can avoid local minimums with a high probability. For each generation, the differential equation model is solved for each chromosome, and the fitness function value, or the variance, is calculated. Different variance definitions have been studied in order to converge to a good solution within a reasonable time frame.

The proposed model with a proper parameter set may provide a platform for predicting tumor growth response to therapies in cancer treatments. Future work includes the application of novel numerical methods such as the adaptive Markov Chain Monte Carlo algorithm on the model for better results. The study has been supported by the National Institute of General Medical Sciences of the National Institutes of Health grant as part of the West Virginia IDeA Network of Biomedical Research Excellence (P20GM103434).

ANDREA B MINIGH*, MEAGAN M. LESSER, MORGAN A. SCARPELLINI, TYLER S. TURNER*, and SARA J. SAWYER, Department of Science and Mathematics, Glenville State College, Glenville, WV 26351. **The effect of increased water temperature on integrin distribution and integrin-related signaling and gene expression in the tropical symbiotic anemone, *Aiptasia pallida.***

Temperature-induced coral bleaching results from the loss of the symbiotic algae, and is known to involve apoptosis of both the host and algal cells. The cellular mechanisms underlying bleaching, including the triggering of apoptosis during bleaching, are not well understood. Work in our lab has focused on how temperature affects the cell-substrate adhesion protein integrins. Not only are integrins important in maintenance of tissue integrity, but they are important regulators of cellular signaling in response to environmental stresses and in controlling cell survival. Increased water temperature from 25 ºC to 30 ºC for 12 hours alters the distribution of integrins in symbiotic Aiptasia pallida, but not in aposymbiotic anemones. Work in the lab is now focusing on whether this alteration in integrin distribution alters cellular signaling in the MAP kinase signaling pathway, or affects gene expression of the early response gene and transcription factor cJun. The effect of increased water temperature on MAP kinase signaling will be assessed by heat shocking anemones from 1 to 48 hours, extracting the proteins, and then performing protein gel electrophoresis and Western blotting using antibodies against the inactive and active form of the MAP kinase signaling protein ERK1/2. How increased water temperature affects the expression levels of the transcription factor and early response gene c-Jun will be assessed by quantitative PCR. Results from these studies will aid in understanding of the cellular signaling that underlies temperature-induced coral bleaching

ANDREA B MINIGH*, MEAGAN M. LESSER, MORGAN A. SCARPELLINI, TYLER S. TURNER*, and SARA J. SAWYER, Department of Science and Mathematics, Glenville State College, Glenville, WV 26351. The effect of increased water temperature on integrin distribution and integrin-related signaling and gene expression in the tropical symbiotic anemone, Aiptasia pallida.

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inactive and active form of the MAP kinase signaling protein ERK1/2. How increased water temperature affects the expression levels of the transcription factor and early response gene c-Jun will be assessed by quantitative PCR. Results from these studies will aid in understanding of the cellular signaling that underlies temperature-induced coral bleaching.

DAVID RUSSELL* and BRUCE ANTHONY, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26101. **Proteomic and genomic analysis of bronchial epithelial cell lines transfected with the cystic fibrosis transmembrane conductance regulator.**

Proteomic and genomic analysis softwares have become strong tools useful in determining disease-related alterations in global gene expression patterns and interactive molecular protein pathways. The objective of this study is to analyze the genomic and protein changes associated with a control and overexpression of the cystic fibrosis transmembrane conductance regulator (CFTR) gene, an ATP-binding cassette of subfamily C, member 7, in the bronchial epithelial cell line IB3-1. We used the Gene Expression Omnibus (GEO) standard dataset for CFTR to examine translational alterations in mRNA expression. Cut-offs for expressional changes were set at 5% variance of normal control. Ingenuity analyzing software was used to identify cellular pathways affected by expressional changes, comparing controls to overexpression of CFTR. We report a set of mRNA expressional changes that were cross-matched to ID Ref. values (given by the database GEO). Initial mRNA analysis suggests alterations in chemokine receptor (CD) expression in multiple hematopoietic cell linages and various upstream DNA transcription factors. Ingenuity analysis suggests alterations in specific hematopoietic cell development affected by CFTR overexpression. Cut-off for expressional changes ranged from 1-5% of the control.

DAVEY WRISTON* and BRUCE ANTHONY, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26101. **Effects of varying alcohol concentrations on embryonic mouse neural stem cell differentiation.**

Striatal neural stem cell (NSC) proliferation and differentiation are differentially affected by high and moderate alcohol exposure in humans. Alcohol effects have been reported to be most altered during binge drinking. We proposed that exposure of embryonic mouse-derived NSC cultures to 300 and 400 mg/dL alcohol for 6-8 hours will alter differentiation patterns. Mouse embryonic NSC cultures were exposed to 6-8 hours of alcohol at varied doses prior to differentiation. To induce differentiation, 10% FBS serum was added to the media. The cell cultures were then differentiated for 5-7 days before being ethanol-fixed and used for immunohistochemistry with NeuN (neurons) or nestin (early glial cells) antibodies developed with alkaline phosphatase. Cells were stained with DAPI (4',6-diamidino-2-phenylindole) to attain nuclear staining for total cell numbers. Antibody-stained cells were counted to gather data on number of glial cells and neurons to total differentiated cells. We suggest that alcohol exposure at either alcohol dose alters the differentiation of NSC.

CHEMISTRY

TIFFANY CLEMENTS*, EDWARD A. WOVCHKO, and JOANNA WEBB, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Ligand screening for a Pt alkene oxidation catalyst.**

Reactions that facilitate C–O bond formation are important for the production of commodity chemicals and fuels. Understanding mechanistic details of C–O bond forming reactions is the key to identifying more efficient catalysts. The model system [Pt(COD)(μ-OH]2(OTf)2 (COD = 1,5-cyclooctadiene; OTf = trifluoromethanesulfonate) catalyzes alkene

oxidation of norbornene and ethylene through a Wacker-type process. Though a 1,2-addition pathway for the C–O bond forming step has been suggested, the dimeric Pt complex complicates detailed mechanistic studies. The present work focuses on the identification of an analogous well-defined monomeric Pt system through ligand screening. The [Pt(COD)(μ-OH]2(OTf)2 is isolated and reacted with various ligands (i.e., triphenylphosphine and bis(diphenylphosphino) ethane) followed by alkene oxidations monitored by GC-MS, IR, and NMR spectroscopy. Through this ligand screening process, successful alkene oxidations suggest ligand–Pt complexes which should be targeted for isolation in order to perform detailed mechanistic studies focused on the C–O bond forming reaction.

ROBERT B. DEWEES* and KEVIN L. EVANS, Department of Science and Mathematics, Glenville State College, Glenville, WV 26351. **Electrophilic aromatic substitution lab.**

Electrophilic aromatic substitution is studied in sophomore-level organic chemistry classes. This project is developing an activity to reinforce the students' understanding of electrophilic aromatic substitutions by studying the directing effects of monosubstituted aromatic compounds in nitration reactions. Substituents attached to the aromatic compound affect both the rate of the reaction and the location (ortho, meta, or para) of substitution. Each student will perform the same nitration procedure, but with a different monosubstituted aromatic compound. The student will characterize the starting monosubstituted aromatic compound and identify the major isomer (ortho, meta, and para) from the reaction using melting point, IR, 1H and 13C NMR spectra. The student will also attempt to determine the relative percentage of each isomer from its spectra. Combining students' experimental results with their knowledge of curved arrow mechanisms will increase their understanding of the directing effects in these reactions.

ADAM FINNISS**, SUSHANT AGARWAL, and RAKESH GUPTA, Department of Chemical Engineering, West Virginia University, Morgantown WV 26506. **Structure and properties of blended polylactic acid and polycarbonate.**

Polylactic acid is a naturally-sourced thermoplastic polymer used primarily for medical devices and food packaging. It is created from renewable agricultural resources such as corn, and its production generates fewer carbon emissions and uses less energy than production of comparable synthetic plastics such as polystyrene or poly(ethylene terephthalate). However, poor ductility and a low heat distortion temperature limit the use of PLA as an engineering plastic in markets such as automotive or electronics. These shortcomings must be addressed in order to achieve more widespread usage. The current study focuses on polymer blends consisting of polylactic acid and polycarbonate. Polycarbonate is added, as its high temperature resistance and good mechanical properties enhance the properties of the resulting blends. The effects of heat treatment and crystallization are investigated. Materials are characterized for mechanical and thermal properties.

Melt blending the materials using a twin screw extruder was found to give a fine morphology and good dispersion of the included phase, in spite of the immiscibility of the two polymers. Differential scanning calorimetry confirms this immiscibility, and was used to obtain crystallization kinetics of the materials. Ductility and impact properties are substantially improved with the addition of polycarbonate.

This work was made possible with funding from Bayer MaterialScience.

JOANNA GAINES* and MELISSA CHARLTON-SMITH, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Adaptation of gas detection tube chemistry to wet analysis of organohalide liquid waste compounds.**

Current organohalide and halide detection products available on the market include gas detection tubes and aqueous test strips. However, there are no available colorimetric testing products for potentially halogenated liquid organic waste. The premise behind commercial halogenated compound gas detection tubes involves the use of strong oxidizers to dehalogenate organohalide air contaminants, producing a halide ion (X*), which is then colorimetrically detected by complex formation with o-tolidine. Using the gas detection tube system as a model, the dehalogenation of liquid organohalides, followed by colorimetric halide detection with o-tolidine indicator solution, was studied in an effort to develop a comparable colorimetric test system for the detection of halogenated hydrocarbons in liquid organic waste. Using o-tolidine as an indicator, primary, secondary, tertiary, and aromatic organohalides were spot tested by treatment with H2SO4/CrO3, H2SO4/I2O5, or a combination of both. Spot tests showed color changes that indicate the presence of halide ion after treatment. These results indicate that the development of a test system for liquid organohalides can be developed. Further testing of various organohalides will continue in addition to the development of test strips using this, or a similar test system.

Support was provided by WV Higher Education Policy Commission Science and Research 2012 Innovation Grant Program for GC-MS analysis.

JESSICA HARVEY* and MELISSA CHARLTON-SMITH, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26201. **Colorimetric determination of the release of bromide ion or bromine radical during Grignard reagent formation.**

The mechanism for the Grignard reagent formation is poorly understood, though there have been many proposed mechanisms. Therefore, the purpose of this research is to determine if a bromide ion or bromine radical is produced during formation of the Grignard reagent. The formation of a bromide ion or bromine radical would likewise confirm the formation of the R group radical transition state. After determining the solubility of otolidine in tetrahydrofuran (THF), a 2% solution of o-tolidine/THF was used to indicate the presence of the bromo species during the formation of the Grignard reagent. Utilized for reaction samples were bromobenzene, magnesium and THF. A control reaction sample (1), a reaction sample with o-tolidine/THF indicator added before initiation (2), and a reaction sample with o-tolidine/THF indicator added after initiation (3) were examined colorimetrically. Reaction sample 2 showed marked color change from colorless to pink and finally to maroon, indicating that the halide ion or halogen radical formed and then complexed with o-tolidine. Reaction samples 1 and 3 showed only typical Grignard formation. This implies that the bromide ion formed during initiation was captured by the o-tolidine reagent, causing the color change, rather than complexing with magnesium to form the Grignard reagent.

Support was provided by WV Higher Education Policy Commission Science and Research 2012 Innovation Grant Program for GC-MS analysis.

JACOB KNICELY* and BRUCE ANTHONY, Department of Chemistry, West Virginia Wesleyan College, Buckhannon, WV 26101. **Examination of topical application of ibuprophen.**

This research is designed to determine the most effective way to apply ibuprofen topically within therapeutic levels. Many current analgesics are used topically to achieve better delivery for focal regions of pain without systemic effects from oral delivery. Previous work has used varied ibuprofen topical mixtures and shown diverse results that need further evaluation. This research will help expand our understanding of the many possibilities for quick and targeted application of a pain relief medicine. Our research used glycerol and menthol combinations in varied percentages with three distinct doses of ibuprofen. We used a 10 topical

applications. This tissue mimics human skin and is an efficient way to assess penetration of topical drugs. Successful penetration of ibuprofen gel was measured using weight analysis of penetrated topical medication, along with HPLC for drug analysis. This study will help to improve topical applications in targeting arthritis and joint pain.

SARA MORRIS* and EDWARD A. WOVCHKO, Department of Chemistry, West Virginia Wesleyan College, 59 College Avenue, Buckhannon, WV 26201. **Preparation and GCMS analysis of perfume samples for an analytical chemistry laboratory experiment.**

Chromatographic separation methods are typically taught in analytical chemistry laboratory courses. However, most investigations involve a routine analysis of a mixture of simple organic compounds. In an effort to introduce modern gas chromatography coupled with mass spectrometry (GC-MS), this project focused on the development of an interesting set of experiments concerning the preparation and GC-MS analysis of perfume samples. Since an average fragrance has 60 to 100 ingredients, the complexity of most perfumes serves as a strong example of the power of capillary column GC for mixture separation. A simple method for the preparation of a perfume sample by steam distillation of natural products will be described. Methods and results from the GC-MS analyses of the prepared perfume will be presented. Mass spectral fragmentation patterns for the sample fractions and MS library searching have elucidated individual chemical components. Details of a comparison of brand-name perfumes and their "imposters" using GC-MS will also be presented.

This project was supported by the West Virginia Higher Education Policy Commission 2012 Innovation Grants Program.

COMPUTER SCIENCE

JASON BERTMAN* and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **Using elliptic curve cryptography to secure web applications.**

Elliptic Curve Cryptography (ECC) is quickly becoming a favorable alternative to traditional public key cryptosystems such as RSA and DSA. The NIST-approved elliptic curves can maintain computationally equivalent security with only a fraction of the key sizes used in RSA. Its smaller key sizes and efficient computation methods allow for lower bandwidth, power, and memory consumption.

This research studies the effect of using ECC in the Secure Sockets Layer (SSL) protocol. Using Apache server 2.0.64, ECC was implemented using OpenSSL. This setup was benchmarked under various conditions, simulating several different NIST-approved curves and server load circumstances. The results show a significant increase in HTTPS requests fulfilled by the server, both from handshakes and concurrent page requests under realistic workloads and acceptable security levels.

JORDAN CANNIN*, JESSICA NOVAK*, WEIDONG LIAO and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **Analyzing and securing the mobile world.**

We have entered a time when the use of mobile devices have become commonplace. As the popularity of these small but powerful devices increases, it raises the question of their security. Mobile devices hold a bank of personal information, which includes geolocation information of individuals, daily agendas, emails and so on. In our research, we examine the overall security model of three mobile platforms; Android, iOS and Firefox OS. In the three security models, we give special focus to the areas of device architecture, encryption systems, file systems, application handling and network management. Through our research, we have proposed possible areas of improvement for Firefox OS, as it is an operating system still in

the development stages. We have also given recognition to vulnerabilities on each mobile platform.

BRADLEY HAMMOND* and HYOIL HAN, Weisberg Division of Computer Science, Marshall University, Huntington, WV 25755. **ReelAdvice+: a movie recommender system ReelAdvice+ is a research project on recommender systems.**

What a recommender system does is to help users find useful items in a world of overwhelming amounts of information. They take known information about users and items to predict what should be useful for certain individuals. These systems already exist, but all work differently because there are different approaches to each field, and each system is usually tailored for its intended use. With our research, we hope to further understand how these systems work and take the different techniques, along with some extra information, to better tailor the system for a movie recommender system.

The method we will use is to combine both collaborative filtering and content-based filtering. The collaborative filtering will be done by clustering users together, and then comparing a single user to these clusters to find the closest related cluster. From this cluster, we retrieve an average rating for a target movie. Once we have this average and standard deviation, we then calculate a score through content based filtering to determine to go up or down from the average within the standard deviation. For content-based filtering, we use movie titles, genres, and tags that the user provided. The recommender system should be able to predict accurate predicted ratings by using 10-fold cross validation without over-fitting to the training data.

ALEX KING* and HYOIL HAN, Weisberg Division of Computer Science, Marshall University, Huntington, WV 25755. **Outlier detection on keystroke biometric data using data mining.**

The goal of this project is to detect outlier on keystroke biometric data using data mining techniques. We use one or more publicly available keystroke datasets and compare our results with the existing work on a selected dataset. The chosen dataset has 51 subjects provided 400 password-typing samples. All 51 users typed the same password, which involves 11 keystrokes. To represent each password typing, the following features are used: (1) Did user press enter key?, (2) Record enter key hold time, (3) KeyDown to KeyDown time between two keys, (4) KeyUp to KeyUp time between two keys, and (5) Hold or Dwell time. The objective of this project is to propose a new algorithm that combines a modified nearest-neighbor Mahalanobis distance with a decision tree update mechanism. The new algorithm will be implemented and tested on the selected publicly-available keystroke dataset using stratified cross-validation. The resulting equal-error rates and zero-miss false alarm rates will then be compared against previous algorithms. The expected outcome is that the new algorithm will offer statistically significant improvements in terms of equal-error rates and zero-miss false alarm rates.

In summary, this project proposes a new algorithm for outlier detection on keystroke biometric data that will improve on previously proposed algorithms by combining a modified nearest-neighbor Mahalanobis distance with a decision tree update mechanism. Improvements are determined by comparing the new algorithm to existing algorithms using the selected publicly available keystroke dataset.

CAMERON J. LOADER*, HYOIL HAN, Weisberg Division of Computer Science, LAURA ADKINS, Department of Mathematics, ELKE FAHRMANN, HENRY K. DRISCOLL, Joan C. Edwards School of Medicine, Marshall University, Huntington, WV 25755. **Data mining for diabetes medical data.**

The existing work on the relationship between hypoglycemia and cardiovascular disease (CVD) is both controversial and inconclusive. In this

project, we are investigating the association between severe and mild hypoglycemia and CVD by mining patient data in a diabetes database. The latter is obtained from the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The database features 1,205 de-identified patient records. We are using supervised machine learning approaches such as rule-based learning and other classification methods and cross-validation for this project. Data mining has not been used widely in medical research. It offers more flexibility than currently-used statistical approaches in terms of model restrictions. The expected outcome is the effect of hypoglycemia and hypoglycemia related factors toward CVD. Feature selection and feature splitting can improve the outcome. In summary, the result of this project will (1) shed more light on the controversial results about the relationship between hypoglycemia and CVD, and (2) help physicians' research and patient care by discovering or identifying patterns and associations of important health factors.

Acknowledgement: The Diabetes Control and Complications Trial (DCCT) and its follow-up, the Epidemiology of Diabetes Interventions and Complications (EDIC) study, were conducted by the DCCT/EDIC Research Group, and supported by National Institute of Health grants and contracts and by the General Clinical Research Center Program, NCRR. The data from the DCCT/EDIC study were supplied by the NIDDK Central Repositories. This manuscript was not prepared under the auspices of the DCCT/EDIC study and does not represent analyses or conclusions of the DCCT/EDIC study group, the NIDDK Central Repositories, or the NIH.

MATTHEW MOCNIAK* and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **The user interface: importance and good practice.**

A user interface can easily be described exactly how it is written. It is an interactive experience that connects a user to some kind of function, machine, or device. User interfaces come in an almost endless number of scales, designs, and forms of functionality. The functionality of a user interface is what really matters. Or is it? Could it be possible that the implementation of a well-designed user interface would improve the functionality and accessibility of a program or function? In this research, we uncover the design process of creating a "good" user interface to increase functionality and accessibility. We also provide visualization to our findings by designing simple applications and comparing the functionality of two identical applications.

SEAN SOVINE* and HYOIL HAN, Weisberg Division of Computer Science, Marshall University, Huntington, WV 25755. **Query enrichment in multi-document summarization.**

Multi-document summarization (MDS) is the process of forming a concise and readable summary of the primary information contained within a set of digital text documents about a single topic. In extractive MDS, the summary is formed from complete sentences extracted from the source documents. In query-focused MDS, the user provides a text query that the MDS system will use to focus the content of the document set summary. Often it is the case that a sentence in the source documents contains relevant information for inclusion in the summary, but doesn't contain any of the exact words in the query. One method for addressing this problem is to enrich the query by adding to the query a list of words that are related to the query terms.

We introduce a method of enriching a query for MDS that utilizes semantic-role parsing on the input document set to identify words that are closely related to query terms. Semantic role parsing labels the verbs in a sentence that act as predicates and the words that form arguments to those predicates. We utilize MDS test data sets from the Document Understanding Conference, organized by National Institute of Science and Technology (NIST), to test our method using

a manual evaluation. Our test results indicate that our query enrichment technique is highly accurate in locating terms that are related to query terms, based on the semantics used within the input document set.

Our work has been partially funded by NASA West Virginia EPSCoR.

CHAD VANORSDALE* and WEIDONG LIAO, Department of Computer Science, Mathematics and Engineering, School of Natural Sciences and Mathematics, Shepherd University, Shepherdstown, WV 25443. **On the security and privacy concerns of the cloud.**

The cloud computing is quickly becoming a part of our everyday experiences. We interact with cloud services often through services such as Spotify, Google Docs, and Dropbox that all provide access to their cloud services. Nevertheless, many people are still hesitating to get into the cloud due to their privacy and security concerns. Our research analyzes the widespread security issues that exist in cloud-based applications, such as securing the environments achieved through virtualization, and also examines privacy concerns that arise from these cloud-based applications. One of our goals is to provide an analysis to see whether many of these commonly-perceived security and privacy issues are real, or largely exaggerated.

The research presented here is sponsored by the UCAR-based SOARS (Significant Opportunities in Atmospheric Research and Science) grant.

TYLER WALDRON*, WEIDONG LIAO and OSMAN GUZIDE, Department of Computer Science, Mathematics and Engineering, Shepherd University, Shepherdstown, WV 25443. **'Breaking' AES.**

AES (Advanced Encryption Standard) is a widely-adopted symmetric-key encryption standard, and has been adopted by the United States government as well. In this paper, we have studied methods to reduce the computations required to decipher data encrypted by AES compared to a brute-force (exhaustive) search; methods of decryption that have less complexity to a brute-force search are considered breaks. While the methods we have studied are still computationally infeasible, they still show apparent weakness, albeit small, in AES.

ECOLOGY

JONATHAN BARNETT*, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Utilizing ASAR imagery for long-term monitoring of a continuous oil seep in the Gulf of Mexico.**

This research explored the possibility of utilizing Synthetic Aperture Radar (SAR) imagery in the long-term monitoring of a continuous oil slick. This SAR imagery has been used to measure and identify sources of oil seeps; however due to limitations in the imagery, the aspects of long-term analysis of these seeps have not yet taken place. A series of advanced SAR (ASAR) images of the Gulf of Mexico, which captured images of the destroyed platform, 23051, were analyzed using ESRI ArcDesktop software. The area of the slick was compared with information reported to the national response center (NRC). It was found that, by analyzing a chronological series of ASAR imagery, enough information about a continuous oil slick can be gathered in order to cross-reference NRC reports, determine areas of impact, and analyze the slick's nature within the body of water. The area measured in the ASAR imagery was significantly greater than the length and width of the slick reported to the NRC, with a 99.5%-99.8% confidence.

RAQUEL FAGUNDO*, MICHAEL LUCERO, and ZACHARY LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Results of the first survey of northern West Virginia's centipede fauna.**

Centipedes are among the least understood

invertebrate fauna occurring in West Virginia. To date, zero publications have been completed by myriapodologists documenting the diversity of centipedes in the state. In an effort to fill this knowledge gap, centipede diversity was surveyed in the northern panhandle (Marshall, Ohio, Brooke and Hancock Counties) within the Appalachian Plateau physiographic province of West Virginia. Site selection was dependent on the presence of moist microhabitats conducive to centipedes. Surveys were completed during the spring and fall months of 2010 through 2012. All animals were vouchered on site and identified in the laboratory. Four orders (Scolopendromorpha, Lithobiomorpha, Geophilomorpha, and Scutigeromorpha) comprising of 10+ species were collected in the panhandle. Geophilomorphs dominate the northern panhandle centipede fauna. The most common species, however, was the lithiobiomorph Bothropolys multidentatus. Scolopendromorphs are the least diverse native order, with Scolopocryptops sexspinosus the most frequently encountered species. Scutigera coleoptrata was the only introduced species encountered, and was allied with anthropogenic habitats.

JESSE KING*, RICK SYPOLT and RICO GAZAL, Department of Land Resources, Glenville State College, Glenville, WV 26351. **Determining Eastern coyote population on Glenville State College Forest.**

In the past 50 years, Eastern coyote *(Canis latrens)* has increased its range and expanded into the eastern United States. It is very important to monitor and manage the population of this species for a balanced ecosystem. To estimate population of eastern coyote, we used scat count method for a two-week period in 2011 and 2012 on a 223-acre tract located on the college forest in Glenville, West Virginia. The sampling techniques used include road (buffer area = 5.78 ac) and plot sampling (plot size = 0.23 ac, n = 10). Existing road network was used for the road sampling technique while Global Positioning System (GPS) was used to locate 10 random plots within the forest. Clean-up was done on both plots and roads as a preparatory activity prior to data collection. Scat was counted after two weeks and were examined to assess coyote's diet. Result of the scat count using the road sampling technique suggests that there were seven coyotes in 2011 but only three in 2012. There was no scat found on all the plots in both years, which shows coyote's primary use of the road network, particularly road intersections. The GPS locations of scat found in both years were very similar, which may indicate coyotes' behavior in consistently marking their territory. Coyotes' diet mainly composed of fruits, vegetation and furbearing animals. This research provides a valuable insight on the future management techniques for this game animal and the importance of monitoring trends in its population and behavior over time.

JOHNNY KING* and RICO GAZAL, Department of Land Resources, Glenville State College, Glenville, WV 26351. **Forest stand management techniques and rainfall amounts improve diameter growth of yellow poplar *(Liriodendron tulipifera).***

To determine the response of tree growth to past silvicultural treatments and amount of precipitation, we measured growth increment from tree rings collected from three stands (mean age=38) of yellow poplar *(Liriodendron tulipifera)* located on the College Forest of Glenville State College, Glenville WV. The forest stands varied in light exposure and the timing of silvicultural treatments applied. The results showed that the amount of precipitation during the growing season was directly correlated to the amount of growth of the stand, but only during the early stages. As the trees matured, the rate of growth did not follow the trend of rainfall. The annual growth pattern was directly correlated with total rainfall (1971-1982) during the growing season ($r2 = 0.19$; $p<0.001$). Before the silvicultural prescriptions were made, all three stands were growing at the same rate, but after the treatment the rate of growth increased. The study of annual growth rings of yellow poplar

revealed that positive diameter growth could be achieved with the application of silvicultural treatments, and that dendrochronology is an effective means to evaluate the effect of forest management techniques on stand growth. The study also shows that the amount of rainfall only has an effect on the amount of diameter growth during the early stage of the trees life, and that other non-climatic variables may also be controlling tree growth, such as slope, soil and stand density.

KELLI LIGHTHISER*, NICOLE SADECKY, RAQUEL FAGUNDO, MICHAEL LUCERO, E. JOSEPH NOLAN, and ZACHARY LOUGHMAN, Department of Natural Resources and Mathematics, West Liberty University, West Liberty, West Virginia 26074. **Crayfishes of the New and Gauley River basins of West Virginia: conservation and natural history.**

The New and Gauley River basins are among the most dynamic lotic waterways in all of West Virginia. During the summer of 2012, 83 streams, 50 in the New and 33 in the Gauley River basins, were sampled for crayfishes to determine both basins' current epigean crayfish fauna. Previous surveys in the 1980s determined that invasive *Orconectes virilis* maintained robust population levels in the upper New River system. A major focus of this endeavor was determining the extent of *O. virilis* invasion into the Lower New and Gauley River systems, as well as determining the current status of the native fauna. Site coverage accounted for all stream orders conducive to crayfishes. Ten seine hauls were completed at each site in the best available habitat to collect crayfishes. Physiochemical and biotic data were collected at each site, and all captured crayfishes were retained as vouchers for identification in the laboratory. The native fauna consisted of *Cambarus* (cf.) *sciotensis, Cambarus carinriostris,* and *Orconectes cristavarius;* all native species population levels were stable. Invasive *O. virilis* were collected from historic locations in Upper New River basin and from three new streams in the Lower New, and were allied mainly with the New River mainstem. In the Gauley River system, *Orconectes virilis* were only collected from Summersville Lake, and were not taken from any lotic situations. Siltation proved to be the most limiting anthropogenic source of pollution, and was prevalent in portions of both river systems that experienced elevated extractive industry utilization.

KASSEN LLOYD*, JUSTIN HILLIARD*, JOSHUA VANOSDOL* and DONALD TRISEL, Department of Biology, Chemistry, and Geoscience, Fairmont State University, Fairmont, WV 26554. **Floristic survey of a managed, mixed mesophytic forest in Marion County WV.**

The Crawford Tree Farm in Marion County, West Virginia (GPS: 39.50587, - 80.06695) is a mixed mesophytic forest that has been in the Crawford family since at least the Civil War. It has been specifically managed to conserve soil resources since 1950 and registered as a tree farm since 1963. It included a total of 378 acres, 315 of which were wooded. Forest types included some oak-hickory dry ridges and some cove hardwood stands. The Crawfords and the U.S. Forest Service collaborated on various projects to manage *Ailanthus altissima* (tree of heaven), and *Celastrus orbiculatus* (oriental bittersweet). A new project was initiated in 2012 to document the vascular flora of the farm. The goal of our surveys was to document the diversity that is possible when our forests are managed properly. Bi-weekly collecting trips were conducted throughout the 2012 growing season, from March 13 to September 30. Over 300 vouchers were collected from at least 264 different specimens. A total of 67 families and 103 genera have been documented to date. As a result of this survey, we are anticipating several new county records that have not been documented in the Checklist and Atlas of the Vascular Flora of West Virginia by Harmon, Ford-Werntz, and Grafton (2006).

This project was funded by a NASA Space Grant through Fairmont State University.

MICHAEL LUCERO*, RAQUEL FAGUNDO, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV; STUART WELSH, U.S. Geological Survey, West Virginia Cooperative Fish and Wildlife Research Unit, Morgantown, WV; ZACHARY LOUGHMAN, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV. **Distribution and conservation status of four Orconectes crayfishes occurring in Virginia's Upper James and Maury River systems.**

Understanding patterns of species occurrence at a watershed scale aids conservation and management efforts for native and non-native species. The Orconectid crayfish fauna of Virginia's Upper James and Maury River basins consists of *Orconectes cristavarius, Orconectes obscurus, Orconectes* sp., and *Orconectes virilis*. Of these taxa, *O. virilis* is a non-native species, and *O. cristavarius* is questionably native to the James River. Fifty-five stream sites were sampled for crayfish and ecological covariates (including elevation) following the Qualitative Habitat Evaluation Index (QHEI) protocol of the Ohio Environmental Protection Agency. We used logistic regression to model species presence as functions of ecological covariates. Model selection and inference were based on the Akaike Information Criterion. *Orconectes obscurus* and *O. sp.* were associated with higher and lower elevations, respectively. *Presence of O. virilis* and *O. cristavarius* was not associated with specific site covariates, a finding consistent with other studies of non-native species. With these results, it is hypothesized that *O. obscurus* and *O. sp.* constitute native species for both river basins, and *O. cristavarius* is considered to be introduced.

AMY PARSONS-WHITE**, Department of Physical Science, Marshall University, Huntington, WV 25755. **Modeling surface water flow and sediment transport in the Twelvepole Creek watershed.**

Surface mining is a common method for the extraction of coal in southern West Virginia. The use of loose spoil on steep slopes for surface mining reclamation sites has been promoted by the US Department of Interior, Office of Surface Mining, for the establishment of native forest. Although low-compaction spoils improve tree survival and growth, the erodibility and hydrology of steep slopes may change due to this practice. The purpose of this study is to model surface water flow and the transport of sediment through a watershed that has been impacted by surface mining and valley fill. Using remotely-sensed data of the Pretty Branch surface mine in the Twelvepole Creek watershed, I will model surface water flow and sediment transport before mining activity began (2007) and again after the valley was filled (2009). A simple rainfall-runoff model will be used to estimate hydrologic response time, and non-parametric techniques will be used to analyze various features of interest over the time series. Results are expected to show a statistically significant change in the surface water flow and the sediment transport in the Twelvepole Creek watershed, specifically in the Pretty Branch of Francis Creek. These results will be used in the further modeling of the watershed to determine if the sediment transport and surface water flow can impact the quality of the ground water, and hence the drinking wells of the residents in the southern West Virginia coal fields.

ADRIAN PATTERSON*, ADAM WILSON*, and ROSS CONOVER, Department of Science and Mathematics, Glenville State College, 200 High St, Glenville, WV 26351. **Influence of free-ranging cats on Carolina wren nestling feeding rates.**

Free-ranging Domestic cats *(Felis catus)* are an introduced predator that represents a significant threat to North American songbird populations. The direct effect (e.g., predation) of Domestic cats on songbird populations is well documented, but indirect effects (e.g., behavior) are less understood. Such effects are likely

to manifest through behavioral changes (i.e., ecology of fear), though little evidence exists to indicate how songbird behavior may be altered by felines. This study will investigate the behavioral effects that free-ranging cats have on nesting Carolina wrens *(Thryothorus ludovicianus)* in Gilmer County, West Virginia. We hypothesize that nestling feeding rates by parents will decrease due to increased nest defense behavior in the presence of a predator (i.e., cat). This will be tested through a field experiment during the 2013 breeding season in Gilmer County, WV. Approximately 25 nest boxes will be placed in suitable Carolina wren habitat. Video cameras will record parental feeding rates for nestlings aged 4-5 days. Feeding rates will be recorded for nests with 1) normal circumstances (i.e., no manipulation), 2) artificial predator presence (i.e., taxidermy mounted cat), and 3) a control group (i.e., taxidermy mounted rabbit). Results from this study will indicate if and how free-ranging cats indirectly influence the nesting behavior and productivity of a native West Virginia songbird. An understanding of these effects may assist songbird conservation efforts and free-ranging cat management strategies throughout North America.

ENGINEERING

BORJA CANTO-TUBILLA**, CHUNCHUAN XU, JOHN ZONDLO, ANNA MCCLUNG, Department of Chemical Engineering, West Virginia University, Morgantown, WV 26505; KATARZYNA SABOLSKY, EDWARD SABOLSKY, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26505. **Direct carbon fuel cells: performance and degradation mechanisms.**

A Direct Carbon Fuel Cell is an electrochemical device that combines the technology of Solid Oxide Fuel Cells (SOFCs) and Molten Carbonate Fuel Cells (MCFCs) to convert the chemical energy of solid carbon directly into electricity. It incorporates a solid electrolyte and molten carbonates with the carbon fuel within the anode chamber to increase reaction active sites. The DCFC employs a planar electrolyte structure of yttrium-doped zirconia (YSZ), with the SOFC multilayer cathode printed on one side and the anode on the other side.

The focus of this research is enhancing the electrochemical oxidation of various carbon fuels on the anode side at temperature range of 650-800 ºC. The candidate carbon fuels were carbon black and different types of biomass (hardwood, corn stover, yellow poplar, switchgrass) with different pretreatments (raw, torrefied, pyrolyzed).

A novel anode structure and anodic mixture was developed and tested with carbon black and a variety of biomasses, raw and pretreated. Among all the pyrolyzed biomass samples (900 °C, N2 atmosphere pretreated), hardwood presented the highest performance (above 65 mW/cm² at 800 °C) and the lowest anode polarization resistance (close to switchgrass). Switchgrass was pretreated at different conditions (raw, torrefied, pyrolyzed), indicating that the torrefied switchgrass (300 °C under N2) gave the highest performance of all the fuels (120 mW/cm² at 800 °C).

The polarization curves and electrochemical impedance spectroscopy were completed on the cells utilizing Solartron 1280Z, and 1260. Post-mortem analysis of the electrolyte was performed utilizing SEM/EDS to assess the effect of fuel contaminates on the anode, electrolyte, and anode/electrolyte interface.

MURAT DINC** and DONALD D. GRAY, Department of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. **Computational investigation of isothermal sprays: effect of nozzle-to-surface distance and spray angle**.

This study considers a conical water spray impinging normally on a flat wall. Isothermal 2D axisymmetric simulations were performed using ANSYS® Fluent. The Navier-Stokes and continuity equations were solved for the air flow using the Finite Volume Method and

a k-ε turbulence model. The trajectories and characteristics of the droplets were calculated using the Discrete Phase Model. The wall-film model was implemented to calculate the radial velocity, height, and mass of the liquid film.

Simulations were run for nozzle-to-surface distance h = 25.4, 31.75, and 38.1 mm, with spray half angle θ = 26.5°, and for h = 38.1 mm with θ = 20.5°. In every case, the velocities and diameters of the droplets decrease as they approach the wall. More secondary droplet splashing occurs as h decreases because the droplets that impact the wall film are faster and larger, but θ has little effect. As h decreases at constant θ, the film velocity increases because of the faster impinging droplets. For all cases, secondary splashing droplets are slower than impinging droplets. The Sauter mean droplet diameters do not depend significantly on h or θ. The spray impact efficiency is the ratio of the mass flowrate (kg/s) of liquid film to the total mass flowrate from the nozzle. For fixed θ, the efficiency does not depend on h, but it increases slightly when θ decreases at fixed h.

This work is supported by NASA Cooperative Agreement NNX10AN0YA.

JENNIFER GORE*, TIMOTHY WEADON, EDWARD M. SABOLSKY, THOMAS EVANS, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV. **Fabrication and testing of Piezoresistive tactile sensors.**

Current research of piezoresistive sensors focuses mainly on controlling and increasing the sensitivity of the composite sensor. Our aim is to analyze the changes in the microstructure in order to better quantify their affects on drift; in addition to making them flexible, durable, and more resistant in extreme environments. The process involves altering the volume fraction of the nano-particle filler material, carbon black, in the 0:3 carbon:polymer based composite, and printing a thin layer onto a conductive surface acting as the electrode. Initial testing is carried out by applying a quasi-static load up to 350 kPa on the surface of the sensors while measuring the change in voltage. Thermomechanical testing is continued through extreme temperatures, between -80 and 120 °C, applying cyclic loading of 350 kPa. Using custom circuitry and Ohm's law, the resistance of the sensors is calculated from the voltage changes. From this information, the changes and drift of the sensors can be quantified.

STEPHEN HAYES**, Department of Mechanical and Aerospace Engineering Center for Alternative Fuels, Engines and Emissions, West Virginia University, Morgantown, WV 26506. **Laboratory for film cooling analysis of gas turbine engines.**

West Virginia University has an experimental laboratory, nearing completion in the design and fabrication stage, to non-dimensionally simulate the aerothermal environment experienced by the components in the first stage turbine in a gas turbine engine. The initial focus of the research of this new laboratory will be to evaluate and compare the performance of an anti-vortex hole geometry, as well as other advanced film cooling geometries. The laboratory will provide the capability of investigating the effect of increasing turbulence levels, as well as various other parameters such as cooling blowing ratio, freestream Reynolds number, and cooling hole spacing, which cover the broad range of engine geometric and aerodynamic conditions. The facility will be capable of testing cooling on flat-plates, leading edge models (for showerhead cooling) and combustor liner and contoured endwall cooling. The laboratory will be used to evaluate novel cooling geometries, and to validate the research in the current study being performed using CFD models. The primary data acquisition system will employ infrared (IR) thermography and thermocouples for surface temperature measurements, hot-wire anemometry for turbulence characterization, and pitot-static probes, pressure transducers, and a laminar flow element for inlet and cooling flow metering and boundary layer measurement. The

test surface for flat-plate testing will be scaled to approximately ten times that of actual gas turbine dimensions to help clearly show how the cooling is affected by each cooling hole design. Preliminary results and data will be presented, if available, at the time of the conference.

TREY KNEPPER*, RICK EGNER and CLARISSA MATHEWS, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443.
Reducing grid-dependent energy use in campus dormitories through conservation and renewable energy.

Energy audits were conducted at Shepherd University's Maple and Birch Residence Halls, Shepherdstown, WV. Energy consumption was estimated via on-site visits to tabulate the number of load-drawing devices, wattages and duration of use and detailed audits of five internal apartments per building, with real-time power meters used to determine usage by device. Each site was analyzed for applicable renewable energy options. In addition, individual responses were tallied from surveys administered to all residents, gathering data on types of devices, duration and frequency of use. The survey data and site-visit data were combined to estimate each building's annual power load.

Recommendations for reducing energy consumption and for installing renewable energy technologies to offset grid-based electricity consumption were made. Actual energy consumption of Maple and Birch Halls was 415,720 and 371,760 kWh/yr., respectively. The study found that adopting conservation recommendations would result in a 40,000 kWh/yr./building reduction in electricity consumption (10% of current grid-dependent power) and an annual savings of $3,600/building. Furthermore, the study concluded that grid-supplied power could be offset by another 10% through installation of a 24 kW solar PV system on each building, with an estimated payback reached in 13 years and a savings of $65,829 over 25 years.

LAUREN KING*, JEFFREY GROFF, and CLARISSA MATHEWS, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443.
Observations of the thermal properties of a solar-thermal greenhouse using an Arduino-based temperature sensor.

With the intention to study time-dependent temperature variations and the radiant heating effects of the concrete foundation in the Shepherd University solar-thermal greenhouse, we developed a low-power temperature sensor with wireless communication using the Arduino prototyping platform. This prototype has three temperature sensors: one near the concrete floor, one at approximate plant growth level, and one near the greenhouse roof. The prototype system was used to gather temperature data at these three vertical positions every five minutes for approximately twenty days. At the time of these temperature observations, the solar thermal system was inactive and the greenhouse was heated solely by solar radiation incident on the greenhouse. In the future, the greenhouse will be connected to a solar thermal system including two collection panels . This system will supply a radiant floor heating system embedded in the concrete foundation. Therefore, the data gathered thus far sets a baseline for the thermal properties of the concrete. This data will be presented and used in the future to adjust the solar-thermal system to achieve higher efficiency. The prototype temperature sensor will also be presented.

LAUREN KING*, GRAHAM HORNE, and CLARISSA MATHEWS, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443.
Reducing grid-based electricity consumption in an historic campus structure: An in-depth energy audit and renewable energy site evaluation of Miller Hall.

An extensive energy audit and on-site renewable energy analysis were conducted

for Shepherd University's Miller Hall, Shepherdstown, WV. This brick building (built 1914) encompasses living space for 29 students and the Residence Life Offices. Through a detailed on-site evaluation of energy consumption, device use, and comparison with utility-supplied records, we determined the annual electricity use, and a student survey allowed us to evaluate average student electricity consumption in the dorm rooms. After analyzing usage patterns, device efficiency and areas of potential conservation, we compiled recommendations for reducing monthly energy consumption through implementation of efficient lighting and appliances and conservation behaviors. We further estimated annual electricity output by solar photovoltaic panels at the site, to determine the capacity for offsetting part of the grid-based electricity load. The analysis showed that conscious energy conservation alone could reduce annual electricity use by 11,936 kWh, and that installation of 80 solar PV panels onsite could reduce the building's grid-based electricity load by an additional 20,697.60 kWh per year, with payback reached within 16 years of installation. Furthermore, the combination of energy conservation measures and solar PV could yield more than $25,000 in savings from year 17 to year 25 following installation.

ANITESH ANAND LAL** and TERENCE MUSHO, Mechanical and Aerospace Department, West Virginia University, Morgantown, WV 26506. **FDTD simulation of a broadband fractal meta-material absorber.**

The main objective of this research was to numerically investigate the absorption characteristics and the total heat generation in a plasmonic fractal metamaterials. In this particular case, the theoretical maximum amount of power from the sun that can be absorbed by these plasmonic devices (PDs) is of interest. This absorbed power would then be harvested for energy generation purposes. A fractal is a geometrical shape whereby each of its parts resemble the same, that is, "self-similar", *ad infinitum.* In addition, metamaterials (MMs) are engineered materials with carefully selected geometries at the nanoscale. Furthermore, a plasmonic device is a metamaterial that exploits the properties of surface plasmons. These plasmons are generated by the interaction of light with metal-dielectric materials. The advantage of MMs is the ability to tune their response to a range of electromagnetic radiation. Tuning of these MMs for boardband response allows their absorption characteristics to supersede that of natural materials such as carbon. The response of MMs to electromagnetic radiation is explained through Maxwell's equations. In this research, the response of the MMs is calculated using a discretized Maxwell's equations in the form of a finite-difference-time-domain (FDTD) approach. Geometric aspects of the MMs such as orientation and spacing were investigated. The response was calculated for a range from 300 THz to 800 THz. Preliminary results indicate that the fractal spacing is a critical parameter in tuning the broadband response whereby the spacing should be on the order or less than 20 nanometers for a given fractal design.

TIMOTHY REPKO**, Department of Mechanical and Aerospace Engineering Center for Alternative Fuels, Engines and Emissions, West Virginia University, Morgantown, WV 26506. **A parametric numerical study of the effects of freestream turbulence intensity and length scale on anti-vortex film cooling design at high blowing ratio.**

Advanced, high-effectiveness film-cooling schemes allow gas turbine engines to operate at increasingly elevated turbine inlet temperatures, increasing their thermal efficiency, while efficiently using available cooling air. A novel film cooling design, the anti-vortex hole (AVH), has been investigated by several research groups, and shown to mitigate or counter the vorticity generated by conventional holes and increase film effectiveness at high blowing ratios and low freestream turbulence levels. The current research presents the results of a numerical parametric study which attempts to separate the

effects of turbulence intensity and scale on film cooling effectiveness of the AVH. In this study, high freestream turbulence intensity and large scale cases were investigated with turbulence intensities of 5, 10 and 20%, and length scales based on cooling hole diameter of $\Lambda x/dm = 1$, 3 and 6. Results showed trends similar to a previous study, and also investigated the effects of intensity and scale separately. Increasing turbulence intensity was shown to increase the centerline, span-averaged and area-averaged adiabatic film cooling effectiveness. Larger turbulent length scales were shown to have little-to-no effect on the centerline, span-averaged and area-averaged adiabatic film cooling effectiveness at lower turbulence levels, but slightly increased effect at the highest turbulence levels investigated.

ZOE SUMRALL*, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. Comparison of theoretical and measured data of photovoltaic energy output.

The research conducted was to compare estimated photovoltaic (PV) energy output of solar panels against the actual energy output after one year of solar energy production. The estimates were provided by Mountain View Solar (MTVSolar) to their clients before solar panels were installed. Actual data from the system accumulated over one year was collected using networking technology from SMA Solar Technology, Solar World, and Enphase Energy, which reports the output information from the array to the internet. Client files were reviewed to find and record the estimate proposed to each client; if no estimate was recorded, one was retrieved using PVWATTS version 1. PVWATTS version 1 is "an online simulation tool for providing quick estimates of electrical energy output of grid-connected PV systems for any Typical Meteorological Year (TMY) database." PVWATTS version 2 allows the user to select "a grid cell containing the desired location…initiating a selection by PVWATTS version 2 of the nearest TMY station (Marion 2001). After comparing the theoretical and actual energy output data, PVWATTS version 1 performance calculator was then compared to PVWATTS version 2. The comparison was done to see which calculator gave a more accurate estimation in relation to the client's actual output. This could more accurately inform the client and allow the sales team at MTVSolar to be as precise as possible in their estimates. The numerical results varied for the two PVWATTS versions. In conclusion, there was no significant difference in the data. Once the data was compiled into Microsoft Excel 2010, it was sent to the sales team at MTVSolar; based on the results, it was decided that they could use either calculator at their discretion

JONATHAN TAUB**, EDWARD M. SABOLSKY, THOMAS EVANS, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26505. **Design, fabrication and characterization of a surface acoustic wave sensor based on PZT thin film for the detection of hypergolic fuels during satellite refueling in the GEO stationary orbit.**

In satellite refueling operations, the detection of fuel leaks during the procedure is a critical assessment to the overall success of the operation. The environmental conditions of GEO stationary orbit in the range of 10-7 Torr and -80 ˚C, as well as the limiting power, size, weight and data processing conditions due to the robotic system, narrowed the selection of possible sensor for this particular application. Surface acoustic sensors utilize an interdigitated transducer (IDT) to convert electrical energy into an acoustic wave. The acoustic wave then travels across the surface of the device to another IDT, converting the wave back into electrical signal. When a leakage occurs and impacts the surface of the device, there will be an alteration in the output electrical (phase shift, frequency shift or time delay). This method provides a sensitive, low power consumption sensor capable of detecting changes in its surroundings. This work

describes the fabrication and characterization of a the entire SAW sensor with a PZT as the piezoelectric material, and a novel approach to increase its sensitivity by adding a diaphragm to its design.

MATTHEW S. THOMPSON**, SUSHANT AGARWAL, and RAKESH K. GUPTA, Department of Chemical Engineering, West Virginia University, Morgantown, WV 26506. **Morphology development in PC/SAN blends: roles of extensional flow and nanoparticle stabilization.**

Immiscible blends of polycarbonate (PC) and styrene-co-acrylonitrile (SAN) are commercially-important engineering polymers, finding applications in automobiles, home appliances and electronic products. The mechanical properties of such blends are known to depend on the phase microstructure, or morphology. In turn, morphology development is known to depend on the balance between drop deformation and breakup, which tends to decrease the dispersed phase size, and drop coalescence, which tends to increase size. Extensional flow fields are more efficient at drop breakup than shear flow fields, and they are required for breakup when the blend viscosity ratio (ratio of viscosity of dispersed phase to that of matrix phase) is greater than about four.

The current work examines the effects of extensional flow fields on the mixing of PC dispersed in SAN, where the viscosity ratio exceeds four for a range of shear rates. Blends were prepared using an internal mixer, and were subjected to extensional flow by forcing them through various converging flow dies attached to the bottom of a capillary rheometer. Dispersed phase drop size was investigated using scanning electron microscopy (SEM) and was found to decrease by as much as a factor of two after extensional flow mixing. The effects of process variables such as temperature, composition, stretch rate, and total strain were also investigated. Fumed nanosilica with a hydrophobic surface treatment was also incorporated into the blend, and the effectiveness of this additive to prevent coalescence was examined.

Support for this project was provided by Bayer MaterialScience.

MICROBIOLOGY

SAMANATHA BOLYARD*, JOHN LOWTHER, STEVEN ROOF and DONALD TRISEL, Department of Biology, Chemistry and Geosciences, Fairmont State University, Fairmont, WV 26554. **The effectiveness of natural products on the inhibition of bacterial growth in nutrient broth.**

This project was designed to screen plant extracts and a few other natural products for potential antibacterial properties. Plants were collected and extracts were prepared by combining approximately 10 g of plant tissue with 100 mL of methyl alcohol, grinding the mixture to a pulp, and filtering the liquid. Extracts were tested for antibacterial activity using serial dilutions in 96-well plates. Absorbances were measured using a Bio Tek Multi-Mode Microplate Reader. The bacteria tested included *Escherichia coli, Staphylococcus epidermidis,* and *Bacillus cereus*.

Over 70 plant species, a fungus, and a few products from the honeybee hive were tested. None of the extracts was effective against *E. coli.* The absorbance values for *B. cereus* were low when the bacteria had been treated with extracts such as tulip poplar, propolis, sassafras, spice bush, and others. These low absorbance values indicate an inhibition in the bacterial growth. Additional research should be conducted to isolate specific compounds and test against a wider range of bacteria.

This research was supported by Fairmont State University SURE grant.

TARA GAJTKA* and JAMES BIRCH*, Department of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV 26074. **Temperature-dependent antibiotic resistance of pathogenic bacteria.**

Antibiotic resistance among pathogenic bacteria is a rising concern. We are interested in studying the effect of temperature on the regulation of antibiotic resistance. High temperature (37 °C) is associated with human infection, relative to lower environmental temperatures where pathogens may exist outside of a human host. Data presented here suggest that most pathogenic bacteria are more resistant to antibiotics at a lower environmental temperature (26 °C) compared to human body temperature (37 °C). To identify genes involved in this resistance, we subjected one such bacterium, *Francisella tularensis,* to transposon mutagenesis. Here, we identified mutants that acquired resistance to antibiotics at 37 °C. Two mutations that produced this phenotype were insertions near different MFS transporter genes. Homologs to the products of these genes have been shown to be involved in multi-drug efflux. During most of the evolution of pathogenic microbes, bacteria only ever encountered antibiotics outside the host, as these chemicals are produced by competing microbes in low temperature environmental niches such as soil. We propose that pathogenic microbes may have evolved a regulatory system to enhance antimicrobial resistance at lower temperatures to enhance survival among competing microbes. *Staphylococcus aureus* was the only bacterial species that was more resistant at the mammalian temperature. Both pathogenic and commensal *S. aureus* colonize the skin and nasopharynx, environments normally at 37 °C. It is therefore plausible that *S. aureus* evolved to enhance production of resistance factors at mammalian temperatures to diminish the effects of antibiotics produced by the normal microbiota of the host.

PSYCHOLOGY

MATTHEW FERGUSON*, JORDAN PARIS and HYOIL HAN, Weisberg Division of Computer Science, Marshall University, Huntington, WV 25755. **Semantic-based classification for sentiment analysis of movie reviews.**

The project aims to analyze movie reviews to determine their polarity for sentiment analysis. We use a publicly-available data set that consists of 50,000 movie reviews. The overall distribution of the data is balanced, with half being positive and the other half being negative. The objective of the project is to add semantic features to improve classification accuracy for sentiment analysis of movie reviews. We focus on selecting features related to semantics to describe movie reviews with emotions such as lovely, happy, horrible, and funny. For semantics, we use Probabilistic Latent Sematic Analysis (PLSA) to cluster semantic words to create semantic classes, which can be used to create a new feature to classify movie reviews. Each word has multiple meanings (i.e., polysemy), and it makes automatic text classification difficult. Word sense disambiguation can provide a means to solve polysemy problems in text mining. We use word sense disambiguation first and then PLSA to find semantic classes in the training data. Because the discovered semantic classes are dependent on training data, we learn semantic classes using as many movie reviews as possible.

Semantic features can provide more meanings than frequency-based classification approaches that focus on the number of occurrences of words in text. We compare our work with the existing approaches that use the same dataset but use different approaches to find semantic classes. We use classification methods (such as Naïve Bayes classification) to treat each term (or word) independently. The project achieves semantic-based classification for sentiment analysis.

JORDAN PARIS* and HYOIL HAN, Weisberg Division of Computer Science, and WON-YUL BAE, Department of Health Profession, Marshall University, Huntington, WV 25755. **Twitter sentiment analysis for a sports team.**

Sentiment analysis is a powerful tool that is becoming more and more important with the rise of social media and microblogging. We observe the sentiment of a popular professional basketball team and see if we can find trends in sentiment polarity when that team loses. We are

interested in sentiment changes before the team start games, during games, and after games. For the project, we collected our own data for two weeks from Twitter via its API. For simplicity, we use the data obtained from games in which the selected basketball team lost. Features that are incorporated into our process to improve sentiment analysis include emoticon dictionaries that allow us to assign varying polarity values to commonly-used emoticons. We also incorporate acronym dictionaries so that we can expand commonly used acronyms into a format that can be used and analyzed.

Lastly, we use semantics that consider the polarity of individual words and the syntax features that are associated with each individual tweet. In the proposed work, we obtain semantic information from WordNet, an online English dictionary. Instead of simple keyword matching to investigate sentiment in the social media, we use synonyms and concept hierarchy in WordNet. This can improve the semantic analysis of sentiment. We believe that, using the aforementioned features, we can achieve an accurate sentiment analysis that will give us useful information about the topic we are studying. We apply our findings to the popular basketball team that can be useful for other fields of study.

ZOOLOGY

NATHAN BRANDT*, SARAH BARRY* and CLARISSA MATHEWS, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443.
Targeting Brown marmorated stink bug *(Halyomorpha halys)* nymphal development via biologically-derived sprays.

The Brown marmorated stink bug (BMSB), *Halyomorpha halys* (Pentatomidae), is an invasive pest causing significant economic losses to farmers due to its extremely broad feeding range and lack of natural enemies in the U.S. The BMSB rely on a gut bacterial symbiont to complete their development through the five nymphal stages, with adult females smearing newly laid egg masses with a liquid coating containing the symbiotic microbe. This project investigated the potential of spraying BMSB egg masses with environmentally-benign biologically-derived 'teas' to disrupt the symbiotic microbe and thereby reduce subsequent generations of BMSB, a tactic applicable to USDA-certified organic production. Dilutions of biological 'teas' made from organic compost and capsaicin were prepared, and compost maturity was estimated via the Dewar flask method. Newly deposited BMSB egg masses (obtained from a laboratory colony) were subjected to RO water spray (control), compost tea spray, or capsaicin tea spray, and held in a growth chamber (25 °C, 24-hour day length). Upon hatching, nymphs were provided water, organic sun flower seeds and green beans. Each cohort of nymphs was tracked through development, and the percentage of nymphal mortality/egg mass and duration of survivorship (i.e., days in nymphal stage) was recorded.

ZOE CHARALAMBOUS* and CAROL Z. PLAUTZ, Department of Biology, Shepherd University, Shepherdstown, WV 25443.
Promoting the pond snail *Lymnaea palustris* as a useful model for developmental biology experimentation.

The pond snail *Lymnaea palustris* is among the gastropods whose embryological development takes place in a capsule. This capsule serves as a source of nutrients and protection during the early stages of development. If the capsule is damaged or destroyed, the risk of abnormal development or fatality increases. The issue with the capsule is related to embryological manipulation. Since the capsule is crucial to embryological development, working with the embryo without the capsule becomes difficult. By studying and understanding the components of the capsule, an artificial capsular fluid (ACF) can be experimentally produced. The production of this ACF will allow for survival without the capsule; this renders embryological manipulation more attainable. In turn, manipulation of the

embryos can help to further our understanding of *Lymnaea palustris development.* This study seeks to establish *Lymnaea palustris* as a developmental model system for the teaching lab. To that end, we have also modified or developed techniques for DNA extraction and immunohistochemistry. These techniques will help to further develop the utility of *Lymnaea palustris* as a model in developmental biology.

This work was supported by a NASA-WV Space Grant Consortium grant for STEM undergraduate research.

CHRISTINE KANNEH* and RUTH A. CONLEY, Biology Department, Shepherd University, Shepherdstown, WV 25443. **Quantitation of communication signals in *Aleuropoda insignis,* the "Flat-horned" hissing cockroach.**

Hissing cockroaches emit hissing sounds that are used during courtship and agonistic encounters, as well when disturbed. Signal characteristics of two species of Madagascar hissing cockroaches have been described: *Gromphadorhina portentosa* emit broadband noises with a loudest or "dominant frequency" component for courtship, agonistic, and disturbance hisses (Nelson and Fraser 1980); while *Elliporhina chopardi* emit courtship "pure whistles" (determined by two independent harmonics) and "noisy whistles" with a high dominant frequency (Sueur, J. and Aubin 2006). Preliminary research has described *Aleuropoda insignis* signals as "whistles" (courtship) or as "broadband noise" (disturbance). We have quantitated agonistic and courtship signal characteristics of *Aleuropoda insignis,* entropy, time continuity, and frequency continuity, using Sound Analysis Pro software. We can then categorize agonistic vs. courtship signals using these calculations. These results indicate that standard signal analysis methods used for identifying and discriminating signal similarities, and differences in birdsong can also be applied to the cockroach communication signals.

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BRENNAN PEDIGO*, Institute of Environmental and Physical Sciences, Shepherd University, Shepherdstown, WV 25443. **Migratory bird nesting rates in a constructed area.**

Migratory birds have been protected by the Migratory Bird Treaty Act since 1918. Nesting migratory birds in Pueblo, CO at a federal government facility were studied over the course of an eleven-week period. Old and new nests were checked for hatchlings every few days. Nest location, number of eggs, and number of hatchlings were recorded on a site map. The Western kingbird *(Tyrannus verticalis)* had the highest number of nests constructed around the facility; the Western meadowlark *(Sturnella neglecta)* and the Common grackle *(Quiscalus quiscula)* were frequently recorded. The data concluded that comparing the amount bird nests and the species of birds the Western kingbird *(Tyrannus verticalis)* has better human adaptation tolerance than the other birds found around the facility.

CLAYTON RAINES*, Department of Biology, Shepherd University, Shepherdstown, WV 25443. **Acute toxicity of road salt on freshwater amphipods.**

Road salts are a commonly used amenity in the mountain state, and of the many options only two are prevalent: sodium chloride (NaCl) and calcium chloride (CaCl2), generally spread at 210 practical salinity units (PSU). The purpose of this study was to use freshwater amphipods, a widespread and resilient member of the benthic macroinvertebrate community, to test the toxicity of commonly-used ice melts. Additional inquiry aimed to determine whether supposedly-"safer" compounds (such as carbonyldiamide) are less toxic. Trials of 48 hours were done in 250 mL beakers, with three replicates for each salt. Initial trials were done at 35 PSU for the three salts, as well as an untreated control. Subsequent trials were run at 17.5 PSU and 8.75 PSU to attempt to identify an LD50 using a liner regression model of the data. The resulting data were analyzed to establish an LD50.

Data from NaCl showed complete mortality at 35 PSU, as well as at 17.5 PSU. The 8.75 PSU showed 80% mortality after 48 hours. Regression models gave a result of an estimated 4 PSU causing 50% mortality. Mortality of CaCl2 at 8.75 PSU was similar, at 90%. Increased mortality caused a lower projected LD50 of 2.5 PSU. Carbonyldiamide yielded 100% mortality at 35 PSU, but at 17.5, and 8.75 PSU mortality was only 10% and 5%, respectively, and thus a projection of 26 PSU.

WENDI WENTZELL*, Department of Natural Science and Mathematics, West Liberty University, West Liberty, WV 26074. **Nursery web and Fishing spiders *(Pisauridae: Pisaurina, Dolomedes)*: observations on distribution and natural history in West Virginia.**

The spider family Pisauridae is represented by the genera *Dolomedes* and *Pisaurina* in West Virginia. The distribution of both genera in West Virginia is poorly known, and has not been investigated since the early 1970s, with the most important taxonomic works excluding West Virginia from their zoogeographic analysis. Collections were performed in late fall of 2012 in northern panhandle counties and Kanawha County, West Virginia. Sites were selected based on access and potential spider habitat. Spiders were collected by hand both day and night, and preserved on site in 70% ethanol, then identified in the laboratory using prominent historical literature. The survey documented five species representing nine county records, with three *Dolomedes* and two *Pisaurina* species, respectively. With this effort, *Dolomedes tenebrosus* and *Pisaurina dubia* were both recorded for the first time in West Virginia. *Pisaurina mira, Dolomedes tenenbrosus, Dolomedes triton* and *Dolomedes vittatus* were all commonly encountered in suitable habitat. P*isaurina brevipes,* a supposedly-common species in the Mid-Atlantic region was not collected with this effort, giving credence to the need for future survey efforts with this enigmatic family of spiders.

RHONDA WILLIAMS*, DAN DILELLA, and RUTH A. CONLEY, Biology Department, Shepherd University, Shepherdstown, WV 25443. **HPLC identification of octopamine in the hemolymph of *Gromphadorhina portentosa,* the Madagascar hissing cockroach.**

A method for detecting and measuring octopamine (OA) from *Gromphadorhina portentosa* (Madagascar hissing cockroaches) was established, followed by optimizing the conditions for analysis using HPLC with electrochemical detection (ECD). Octopamine is a biogenic amine that functions as a neurohormone. Hemolymph was collected in 0.1 M formic acid, centrifuged and analyzed using HPLC-ECD. The ECD detects the amine group on the OA molecule, which becomes a positive radical. Mobile phases were a phosphate buffer and a citric-acetate buffer. Different methanol concentrations, pHs and voltages were tested to determine which conditions were most sensitive to OA. The 6.7 pH phosphate buffer at 900 mV showed a peak absorption with 149,000 area units, whereas the 3.6 pH citric acetate buffer at 950 mV showed 141,000 area units. When comparing the picogram sensitivity, the phosphate buffer was more sensitive. Results showed 274 picograms of OA could be detected using a 6.6 pH phosphate buffer, and only 60 picograms using a 3.5 pH citric acetate buffer. Peak separation of OA was not ideal, because many components of the hemolymph absorb in the same area as OA. Questionable OA peak absorptions could be verified as OA using a sample with a known OA concentration and comparing it to the original sample. However, further research should be done in order to get a clear OA peak. If OA can be identified and quantified using HPLC-ECD, then scientists can conduct experiments that involve monitoring behaviors and reactions in accordance with OA levels found in hemolymph.