2010

2010 Symposium Brochure

WVNANO SURE/REU/IRES/CAREER, WVU HONORS SURE, BIOLOGY REU

SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM 2010

THURSDAY, JULY 29, 2010
CREATIVE ARTS CENTER
WEST VIRGINIA UNIVERSITY
MORGANTOWN, WV

WVNANO.WVU.EDU WWW.AS.WVU.EDU/BIOLOGY WWW.HONORS.WVU.EDU

BUILDING THE FUTURE OF WEST VIRGINIA, ONE IDEA AT A TIME

Summer Undergraduate Research Symposium 2010
West Virginia University

Thursday July 29, 2010
WVU Creative Arts Center

I. Schedule of Events

9:00 AM	Poster Setup ─*Undergraduate participants arrive, register, and put up posters. Participants must leave CAC by 9:30 AM and should return at 11:00 AM.*
9:30 AM	Poster judging ─ *no participants present and not open to public*
11:00 AM	Welcome and Key Note Speaker ─ *all welcome: parents, research advisors, graduate students, undergraduate participants, and general public*

- *Welcome: Dr. Keith Garbutt, Dean of the Honors College*
- *Opening remarks: Dr. David Lederman, WVNano Interim Director*
- *Key Note Speaker: Dr. Michele G. Wheatly, Provost, WVU*

12:00-2:00 PM	Poster Presentations ─ *Open to all and concurrent with final judging of posters. Tiebreaker for poster judging will be participant's ability to answer questions related to his/her research.* ***Judges have preference!***
2:00-3:00 PM	Awards Ceremony and Closing Remarks
3:00 PM	Poster Take-Down ─ *Any posters remaining after 3:30 PM will be removed by the staff.*
3:05 PM	*Post-questionnaires (WVNano REU/SURE participants)*

II. Poster Judges

Judge	**Category Judging**
Kevin Lee, Biology	*Biological Sciences*
Jonathan Boyd, Chemistry/Toxicology	*Biological Sciences*
Tim Phipps, Agric. Res. Economics	*Agricultural & Environmental Sci.*
Doug LaVergne, Resource Management	*Agricultural & Environmental Sci.*
Yuxin Liu, Comp. Sci. & Elect. Eng.	*Physical Sciences and Engineering*
Parviz Famouri, Comp. Sci. & Elect. Eng.	*Physical Sciences and Engineering*
Daneesh Simien, Mech. & Aerosp. Eng.	*Nanosciences*
Peter Perrotta, Pathology	*Nanosciences*

We want to take this opportunity to thank our poster judges. Their willingness to act as judges for this event is greatly appreciated by the organizers and participants!

WestVirginiaUniversity.

III. Undergraduate Participants and Faculty Research Mentors

A. WVNano Research Experiences for Undergraduates (REU) Site: Multifunctional Nanomaterials (PI: Dr. Michelle Richards-Babb; co-PI: Dr. David Lederman)

Participant	Major	Home School	Faculty Advisor
Autumn Bullard	Elect. Eng.	Norfolk State U.	Dr. Lisa Holland, Chemistry
Henelle Davis	Chemistry	Winston-Salem St. U.	Dr. Peter Gannett, Pharmacy
Dominic Gutierrez	Mech. Eng.	American River C.	Drs. Larry Hornak and Dimitris Korakakis, Elect. Eng.
Kaitlin Hensal	Chemistry	St. Francis U.	Dr. Justin Legleiter, Chemistry
Caroline Kilemi	Biology	Coppin State U.	Dr. Jeremy Dawson, Elect. Eng.
Benjamin Rudolph	EE & CE	Western Carolina U.	Dr. Mikel Holcomb, Physics
Kayla Sapp	Chemistry	York College of PA	Dr. Boyd Edwards, Physics
D. Hudson Smith	Physics/Math	Erskine College	Dr. Sergei Urazhdin, Physics
Angel Watson	Biology	Winston-Salem St. U.	Dr. Peter Gannett, Pharmacy
Thomas Wood	Mat. Chem.	WV Wesleyan College	Dr. Lloyd Carroll, Chemistry

B. Biology Research Experiences for Undergraduates (REU) Site: Biological Responses to the Environment from Genes to the Ecosystem (PI: Dr. Richard Thomas)

Participant	Major	Home School	Faculty Advisor
Joshua Ash	Geography	West Virginia U.	Dr. Amy Hessl, Geology & Geography
Katlyn Amos	Forestry & Nat. Res.	Concord C.	Dr. Todd Petty, Forestry & Nat. Res.
Amanda Black	Biology	Gettysburg College	Dr. Stephen DiFazio, Biology
Cody Greer	Biology	U. of Kentucky	Dr. William Peterjohn, Biology
Corey Hazekamp	Plant & Soil Sci.	U. of Colorado	Dr. Can Panaccione, Plant & Soil Sci.
Benjamin Hedin	Biology	Allegheny College	Dr. Richard Thomas, Biology
Kathryn Jeanfreau	Forestry & Nat. Res.	U. of San Francisco	Dr. James Anderson, Biology
Stevia Morawski	Biology	American U.	Dr. James McGraw, Biology
Peter Wallenhorst	Biology	U. of Kentucky	Dr. Rita V.M. Rio, Biology
Amelia Snyder	Forestry & Nat. Res.	Warren Wilson C.	Dr. Nicolas Zegre, Forestry & Nat. Res.

C. WVNano Summer Undergraduate Research Experiences (SURE) Site (Coordinator: Dr. MichelleRichards-Babb; WVNano Interim Director: Dr. David Lederman)

Participant	Major	Home School	Faculty Advisor
Jamie Barr	Chem. Eng.	West Virginia U.	Dr. Peter Gannett, Pharmacy
Benjamin Bearce	Elect. Eng.	West Virginia U.	Dr. Larry Hornak, Elect. Eng.
Tiffany Dolan	Chemistry	West Virginia U.	Dr. Lisa Holland, Chemistry
Kristen Felice	Chemistry & Forensics	West Virginia U.	Dr. Daneesh Simien, Mech.& Aerosp. Eng.
Brandi Findley	Biology	West Virginia U.	Dr. Letha Sooter, Pharmacy
Timothy Gaydos	Chemistry	West Virginia U.	Dr. Aaron Timperman, Chemistry
Makenzie Green	Math & Span.	West Virginia U.	Dr. James Lewis, Physics
Frank Hamilton	EE & CE	West Virginia U.	Dr. Andrew Cao, Comp. & Elect. Eng.

Participant	Major	Home School	Faculty Advisor
Zain Jafri	Biometric Syst. & Comp. Sci.	West Virginia U.	Dr. Larry Hornak, Elect. Eng.
Jessica Lankford	Mech. & Aerosp. Eng.	West Virginia U.	Dr. Nick Wu, Mech. & Aerosp. Eng.
Jessica Lear	Forensic & Inv. Sci.	West Virginia U.	Dr. Feruz Ganikhanov, Physics
Eugene Lewis	Chem. Eng.	West Virginia U.	Dr. Charter Stinespring, Chem. Eng.
Nicholas Mariani	Mech. Eng.	West Virginia U.	Dr. Nick Wu, Mech. & Aerosp. Eng.
Tyler McElfresh	Mathematics	WV Wesleyan C.	Dr. Boyd Edwards, Physics
Charles Ndhlovu	Mining Eng.	West Virginia U.	Dr. Ed Sabolsky, Mech. & Aerosp. Eng.
Adly Noore	Biology/Math/ Comp. Sci.	West Virginia U.	Dr. Bingyun Li, Orthopedics
Matthew Payne	Chem. Eng.	West Virginia U.	Dr. Lloyd Carroll, Chemistry
Sripadh Sharma	Chem./Biol.	West Virginia U.	Dr. Michael Shi, Chemistry
Clinton Smith	Mech. & Aerosp. Eng.	West Virginia U.	Dr. Xueyan Song, Mech. & Aerosp. Eng.
Brittany Witherspoon	Chemistry	West Virginia U.	Dr. Eva Toth, Curriculum & Inst. Lit.
Matthew Zitney	Sec. Ed./ Physics/Math	West Virginia U.	Dr. Michelle Richards-Babb, Chemistry

D. WVNano SURE Participants Supported by Faculty Research Advisors (Drs. Cersela Dinu and Feruz Ganikhanov)

Participant	Major	Home School	Faculty Advisor
Alan Campbell	Chem. Eng.	West Virginia U.	Dr. Cerasela Dinu, Chem. Eng.
Michael Lynch	Chemistry	West Virginia U.	Dr. Feruz Ganikhanov, Physics
Joseph Malone	Chemistry	West Virginia U.	Dr. Cerasela Dinu, Chem. Eng.
Sara Swanson	Chem. Eng.	West Virginia U.	Dr. Cerasela Dinu, Chem. Eng.
Thomas Sobray	Chem. Eng.	West Virginia U.	Dr. Cerasela Dinu, Chem. Eng.

E. International Research Experience for Students (IRES) (PI: Dr. James Lewis; IRES Coordinator: Hong Wang)

Participant	Major	Home School
Suzan Bilgesu	Biology	West Virginia U.
Neil Bowman	Comp. Eng.	West Virginia U.
Zachary Cohen	Mech. Eng.	West Virginia U.
James Eakins	Physics	West Virginia U.
Sarah Robinson	Biology	West Virginia U.

F. International Research Experience for Students (IRES) funded by CAREER Award (PI: Dr. Michael Shi; IRES Coordinator: Hong Wang)

Participant	Major	Home School
Jessica Carr	Chemistry	West Virginia U.
Alexandria Harris	Chem. Eng.	West Virginia U.
Nicholas Horvath	Chem. Eng.	West Virginia U.
Casey Nassif	Chemistry	West Virginia U.
Jonathan Turner	Chemistry	West Virginia U.

G. WVU Honors Summer Undergraduate Research Experiences (SURE) Site (PI: Dr. Keith Garbutt; SURE Instructor: Amy Cyphert; SURE Teaching Assistant: Chelsea Richmond)

Participant	Major	Home School	Faculty Advisor
Loren Bane	Human Nut. & Spanish	West Virginia U.	Dr. Kristen Matak, Animal & Nutr. Sci.
John Barnard	Biochemistry	West Virginia U.	Dr. Kenneth Blemings, Animal Science
Emma Berry	Undeclared	U. of Richmond	Dr. Aaron Metzger, Psychology
Ashley Campasino	Animal & Nutritional Sci.	West Virginia U.	Dr. Holly Spooner, Agric. & Nat. Res.
Heather Campbell	Biology	West Virginia U.	Dr. Jen Stueckle, Biology
Jeffrey Conrad	Aerosp. Eng.	West Virginia U.	Dr. James Smith, Mech. & Aerosp. Eng.
Amber Cook	Chemistry	West Virginia U.	Dr. Jonathan Boyd, Chemistry
Angela Cortes	Physics & Math	West Virginia U.	Dr. Maura McLaughlin, Physics
Andrew Craig	Psychology	West Virginia U.	Drs. K. Andy Lattal & Elizabeth Kyonka, Psychology
Scott Ferris	Physics	West Virginia U.	Dr. James Lewis, Physics
Erica Fitzsimmons	Biology	West Virginia U.	Dr. E. Pena-Yewtukhiw, Plant & Soil Sci.
Derek Gilbert	Biology	West Virginia U.	Dr. Rita V.M. Rio, Biology
Joseph Hopkins	Ex. Physiol.	West Virginia U.	Dr. Rita V.M. Rio, Biology
Thomas Hughes	Biology	West Virginia U.	Dr. E. Pena-Yewtukhiw, Plant & Soil Sci.
John Hunter	Chemistry	West Virginia U.	Dr. Kung Wang, Chemistry
Erica McDermott	Animal & Nutritional Sci.	West Virginia U.	Dr. Jorge Flores, Biology
Katilin Mock	Human Nutr. & Foods	West Virginia U.	Dr. Janet Tou, Animal Science
Stephen Mandish	Biology	West Virginia U.	Dr. Vagner Benedito, Plant & Soil Sci.
Grant Neely	Biochemistry	West Virginia U.	Dr. K. Marie Krause, Animal & Nutr. Sci.
Aaron Ross	Environment. Geoscience	West Virginia U.	Dr. Brenden McNeil, Geography
Ben Sade	Biology	Shepherd University	Dr. Alan Sextone, Plant & Soil Sci.
Grace Skaff	Biochemistry	West Virginia U.	Dr. Vagner Benedito, Plant & Soil Sci.
Savanna Tate	Biology	West Virginia U.	Dr. Jorge Flores, Biology
Garrett White	Pre-pharmacy	West Virginia U.	Dr. Lloyd Carroll, Chemistry
Jeremy Zhou	Electrical Eng.	West Virginia U.	Dr. Daryl Reynolds, Comp. Sci. & EE

H. WVNano SURE/4-H Camp Science Outreach (Coordinator: Dr. Michelle Richards-Babb; co-Coordinator: Dr. Michael Vannatta; Curriculum Development: Eric Kincaid; 4-H Extension Curriculum Specialist: Chad Higgins; Assoc. Director Extension: Roger Hanshaw)

Participant	Major	Home School	Faculty Advisor
Ashley Neal	Sec. Ed./ Chemistry Cert.	West Virginia U.	Dr. Michelle Richards-Babb, Chemistry
Matthew Zitney	Sec. Ed./ Physics/Math	West Virginia U.	Dr. Michelle Richards-Babb, Chemistry

IV. Speakers at REU/SURE Events

Speaker	Affiliation	Group	Topic
David Lederman	Dept. of Physics WVU	WVNano REU	Basis Aspects Nanosci./Eng.
Barbara Foster	Dept. of Chemistry WVU	WVNano REU & SURE	Laboratory Safety
Lloyd Carroll	Dept. of Chemistry WVU	WVNano REU	Intro. to Nanosci. Instrum.
Keith Garbutt	Honors College/Dept. of Biology, WVU	Honors/WVNano SURE	Scientific Ethics
		Honors/WVNano SURE	Effective Presentations
Michelle Richards-Babb	Dept. of Chemistry WVU	WVNano REU	Oral Present. Skills/Lab Notebks
		Honors/WVNano SURE & WVNano REU	Effective Poster Presentations
Linda Blake	Wise Library WVU	WVNano REU & SURE	Scientific Search Tools
Kolin Brown	WVNano Shared Fac. WVU	WVNano REU & SURE	Cleanroom Training & Chemical Safety
Milan Vavrek	Academician: Assoc. Prof., Glenville St. C.	Biology REU & Honors/WVNano SURE	Career Mentoring & Research
Amy Cyphert	Honors College WVU	Honors/WVNano SURE	ASPIRE program & Scholarships
Ronald Clawson	Industry: Adv. Sr. Res. Scientist, Alliant Tech.	WVNano REU & Honors/WVNano SURE	Career Mentoring & Industry
Joeseph Kent	Law: Attorney-Patents K&L Gates	WVNano REU & Honors/WVNano SURE	Career Mentoring & Law/Intellectual Property/Patents
Katie Stores	Grants Management Spec., WVU	Honors/WVNano SURE	Grant Writing Workshop
Mark Hoover	Government Lab NIOSH	WVNano REU	Government Lab Work & Tour of NIOSH facilities
Vincent Castranova	Government Lab NIOSH	WVNano REU	Nanotoxicity
Gera Jochum	President's Council of Advisors for Science and Technology (PCAST)	WVNano/Biology REU & Honors/WVNano SURE	Career Mentoring & Government Work

Our summer programs have been enriched by the contributions of these speakers. We are deeply appreciative and want to thank all of our speakers for their time, effort, and support of summer undergraduate research experiences at West Virginia University!

V. Websites

Need more information?
WVNano: http://wvnano.wvu.edu
WVNano REU: http://wvnano.wvu.edu/reu
WVNano SURE: http://wvnano.wvu.edu/sure
Biology REU: http://reu.as.wvu.edu
WVU Honors administered SURE: www.honors.wvu.edu/sure
4-H: http://www.wvu.edu/~exten/depts/famyou/4-H&Youth.htm

VI. Acknowledgements

A. Personnel

WVNano REU
Michelle Richards-Babb, PI
David Lederman, co-PI
Christie Zachary, WVNano Public Relations
Ashley Neal, Graduate Guide/mentor
Erica Simmons, Support

WVNano SURE
Michelle Richards-Babb, Educ. Coord.
David Lederman, WVNano Interim Direct.
Christie Zachary, WVNano Public Relations
Erica Simmons, Support
Lisa Sharpe, Budgeting & Financial Assist.

Biology REU
Richard Thomas, PI
Kenny Smith, Graduate guide/mentor

IRES/CAREER
Michael Shi, PI.
Hong Wang, IRES Coordinator

IRES
James Lewis, PI
Boyd Edwards, co-PI
Pete Gannett, co-PI
David Lederman, co-PI
Michael Shi, co-PI
Hong Wang, IRES Coordinator

WVU Honors administered SURE
Keith Garbutt, PI
Amy Cyphert, SURE Coordinator
Chelsea Richmond, SURE Intern

WVNano SURE/4-H Camp
Michelle Richards-Babb, Coordinator
Michael Vannatta, co-Coordinator
Chad Higgins, 4-H Curriculum Specialist
Roger Hanshaw, Assoc. Direct. Ext.
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Ashley Neal, Curriculum Delivery
Matthew Zitney, Curriculum Delivery
Dorothy Nelson, LaserFest Curriculum Delivery

Symposium Booklet
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Ashley Neal
Christie Zachary
Erica Simmons

Symposium Planning
Chelsea Richmond
Amy Cyphert
Keith Garbutt
Christie Zachary
Michelle Richards-Babb
Erica Simmons

B. Financial Support

1. **WVNano REU (PI: Michelle Richards-Babb, co-PI: David Lederman)**
National Science Foundation (NSF) Divisions of Materials Research and Chemistry (DMR-1004431) with recreational activities funded by WVU Research Corporation and the WVU Eberly College of Arts and Sciences.

2. **Biology REU (PI: Richard Thomas)**
Sponsored by the NSF Division of Biological Infrastructure (DBI-0849917) and in part by the WVU Department of Biology, WVU Eberly College of Arts and Sciences, and WVU Office of Provost.

3. **WVNano SURE**
Sponsored by the NSF WVEPSCoR program and a Research Infrastructure and Improvement (RII) grant.

4. **IRES (PI: James Lewis, co-PIs: B. Edwards, D. Lederman, P. Gannett, and M. Shi)**
Sponsored in part by the National Science Foundation OISE IRES/DDEP-0824860, NSF WVEPSCoR program/RII grant, and the WVU Eberly College of Arts and Sciences.

5. **IRES/CAREER (PI: Michael Shi)**
Sponsored in part by the National Science Foundation CAREER ??, NSF WVEPSCoR program/RII grant, and the WVU Eberly College of Arts and Sciences.

6. **WVU Honors administered SURE (PI: Keith Garbutt)**
Sponsored in part by the West Virginia Research Challenge Fund through a grant from the Division of Science and Research, HEPC, WVU, Davis College of Agriculture, Forestry and Consumer Sciences, Eberly College of Arts and Sciences, the College of Engineering and Mineral Resources and The Honors College.

7. **WVNano SURE/4-H Camp Outreach (Director: Michelle Richards-Babb)**
Partially funded by WVNano, NSF WVEPSCoR program/RII grant, and the WVU Extension Service.

8. **LaserFest (PI: James Lewis)**
Funded by a physics sponsored research grant in the amount of $8,000. Volunteers from the WVU Society of Physics Students and the Institute of Electrical and Electronics Engineers (IEEE) student branches presented the traveling laser show at county 4-H camps.

9. **Research Symposium Monetary Prizes**
Sponsored by the NSF WVEPSCoR program and a Research Infrastructure and Improvement (RII) grant).

Biological Sciences Category

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Poster 10: *Two dimensional electrophoresis separation of coral proteins.* Timothy Gaydos, Callee Walsh, and Aaron Timperman.

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Poster 14: *Assessment of selection on cellulose synthase–like genes and germin-like genes in Populus trichocarpa.* Amanda N. Black, Eli Rodgers-Melnick, and Stephen P. DiFazio.

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Biological Sciences Category

Poster 16: *Classification of epidermal bacteria via 16S rRNA clonal analysis for forensic human identification.* Brandi N. Findley and Letha J. Sooter.

Poster 17: *Characterizing single stranded binding protein interactions with SSDNA using Single Molecular Force Spectroscopy*. Casey Nassif, Zhang Wei, and Wenke Zhang.

Poster 18: *Mixed Messages Sent During Parent-Adolescent Communication Regarding Tobacco Use.* Emma Berry and Aaron Metzger.

Poster 19: *An Analysis of the Efficacy of Cationic Antimicrobial Peptides*. Adly Noore and Bingyun Li.

Poster 20: *Mathematical Analysis of Separation of Small Particles using Traveling-Field Type Electric Curtain Device*. Tyler W. McElfresh, Robert Correll, and Boyd F. Edwards.

Biological Sciences Category

Bio Sci Poster 1:

Methoprene and multiple stressor impacts on the energetic status of post-molt *Uca pugnax*

Heather Campbell†, Jennifer L. Ripley†, Christy Foran‡, Todd Stueckle*
†Biology Department, West Virginia University, Morgantown WV
‡New England District, U.S. Army Corps of Engineers, Concord, MA
**Basic Pharmaceutical Sciences, WVU Research Corporation, Morgantown WV*

Pesticides such as methoprene and permethrin are applied in coastal regions to control mosquito populations and are hypothesized to act as invisible endocrine disruptors in crustaceans. The purpose of this study was to examine single compound and mixture effects of these contaminants on the energetic status and protein expression of post-molt fiddler crabs (*U. pugnax*). Crabs were subjected to a molting and limb regeneration challenge under environmental levels of methoprene. A subsequent molting challenge studied the impacts due to multiple stressor exposure of methoprene, permethrin and salinity. Male crabs displayed a decrease in HP protein and variable carbohydrate content. In the multiple stressor exposure, crabs at low salinity and increasing methoprene concentrations exhibited decreased HP protein, increased HP lipid and decreased EP protein content. HP carbohydrate content increased with increasing methoprene concentrations. Western blot analyses showed alterations in proteins associated with cellular structure and protein metabolism. This study lends further insight to how chronic exposure to environmental levels of multiple endocrine disruptors impact sensitive and energy demanding growth and development processes in marine invertebrate taxa.

Bio Sci Poster 2:

Tsetse (Diptera: Glossinidae) symbiont biology: *Sodalis* mutagenesis and timing of *Wigglesworthia* migration.

Joseph B. Hopkins, Anna K. Snyder, and Rita V.M. Rio
Department of Biology, West Virginia University, Morgantown, WV 26506

Tsetse flies (Diptera: Glossinidae) are the obligate vectors of trypanosomes, the etiological agents of fatal African trypanosomiasis. Tsetse harbor a simple symbiotic flora consisting of three bacterial species. These bacteria have been shown to affect various aspects of tsetse biology and therefore have potential roles in vector control efforts. Two of these bacteria, *Wigglesworthia* and *Sodalis*, reside in the tsetse midgut and are vertically transmitted via maternal milk gland secretions prior to vivipary (i.e. live birth). The objectives of this study are firstly, to analyze a genetic mutagenesis technique for *Sodalis*, and secondly, to define the timing of the *Wigglesworthia* migration towards seeding the milk glands for progeny infection. A gene disruption technique, Sigma-Aldrich TargeTron® Gene Knockout System, was performed on the *Sodalis* genome. *Wigglesworthia* migration was evaluated using fly dissections, DNA isolation, and PCR. Successful mutagenesis of *Sodalis* will allow for future investigations examining potential contributions towards vector competence. Furthermore, *Wigglesworthia* migration to female milk glands was shown to occur between 2-14 days after adult emergence and without the necessity of mating.

Biological Sciences Category

Bio Sci Poster 3:

Engineering plasmid vectors for high-efficiency transformation of legumes via *Agrobacterium tumefaciens*

Steve Mandish, Grace Skaff, Vagner Benedito
Plant and Soil Sciences Division, Laboratory of Plant Functional Genetics, West Virginia University, Morgantown, WV

Genetically transforming legume species has proven to be challenging. Reasons for the low transformation rates include low embryogenesis rates of transformed cells, high rates of apoptosis, high usage of metabolic energy, and toxicity to selection agents. Starting with the binary vector PCAMBIA1305.2, many cloning steps were taken to address these issues. The constitutive CaMV35S promoter region of the GUSPlus visual marker cassette has been replaced with the Arabidopsis light inducible promoter LHCB1.1. The hygromycin resistance gene has been replaced with a mutated Arabidopsis AHAS cassette. This codes for resistance to imazapyr, a herbicide that is efficient as a selection agent for legumes. A dexamethasone-inducible system, with the 35S promoter exchanged for the Arabidopsis EF1ß promoter, was added to express certain genes of interest when a steroid is introduced to the plant. A Gateway cloning system was also introduced to the vector for the purpose of easily introducing genes of interest for testing. The genes of interest include BABYBOOM(embryogenesis), SERK1(Embryogenesis), HTA1(cell death), and ATBI1(cell death). These will be tested on tobacco as well as the model legume *Medicago Truncatula* 'Jemalong A17'.

Bio Sci Poster 4:

Impact of glycolysis on the design of kinase-targeted chemotherapeutics

Amber C. Cook, Holly N. Williams, Xueli Gao and Jonathan W. Boyd
C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV

Protein kinases play key roles in signaling pathways that regulate cellular functions such as proliferation and apoptosis. Due to their potential regulatory control over such important biological processes, interest in kinase-targeted chemotherapeutics has grown exponentially in the drug discovery arena. Current drug design is aimed at developing substrate-competitive kinase inhibitors, which are thought to offer higher selectivity over ATP-competitive kinase inhibitors who must compete with high intracellular ATP concentrations. However, what has not been explored as comprehensively is the impact that glucose metabolism has on the toxicity induced by these two different types of kinase inhibitors. Cancer cells, like the HepG2, can utilize increased glycolytic activity to produce ATP; while non-cancer cells, such as H9c2, must rely more heavily on oxidative phosphorylation as their means of energy production. This study seeks to investigate the activity of Akt Inhibitor III (SH-6), a substrate-competitive inhibitor, and Akt Inhibitor IV, an ATP-competitive inhibitor, in relation to glycolysis. Our results suggest the ATP-competitive inhibitor paired with glucose inhibitor, 2-Deoxy-D-glucose, may be a more effective chemotherapeutic (increased activity and decreased toxicity) when compared to the substrate- specific compound.

Biological Sciences Category

Bio Sci Poster 5:

Consumption of Different Sugar-Sweetened Beverages Alters Fatty Acid Composition in Growing Rats

Kaitlin Mock, Janet C. Tou, Levi Berg, Joseph Gigliotti
Division of Animal and Nutritional Sciences, West Virginia University, Morgantown, WV

The population's increased intake of sugar-sweetened beverages is suggested to be a major contributor to the increased prevalence of obesity. Beverages are sweetened with a variety of different sugars. The objective of this study was to determine if the type of sugar consumed plays a role in lipogenesis, and the health effects. In this study, young female Sprague-Dawley rats were assigned to one of four treatments: deionized distilled water (ddH_2O, control), ddH_2O with sucrose, fructose, or high fructose corn syrup (HFCS-55). Samples were taken from the liver, and gonadal and retroperitoneal fat pads. Liver tissue was chosen because lipogenesis occurs in the liver. Our preliminary results showed that the final body weight was significantly greater ($P<0.05$) for the HFCS-55 group compared to the control and glucose groups. The liver weight was also significantly greater ($P<0.05$) for the HFCS-55 group compared to the control group. These values suggest that HFCS-55 is promoting lipogenesis.

Bio Sci Poster 6:

Cytotoxicity of carbon nanotubes investigated with human epithelial cells

Sara A. Swanson[1], David Lowry[2], Linda Sargent[2], and Cerasela Zoica Dinu[1]
[1] *College of Engineering and Mineral Resources, West Virginia University, Morgantown, WV*
[2] *National Institute of Occupational Safety and Health (NIOSH), Morgantown, WV*

Carbon nanotubes are molecular-scale graphitic tubes of carbon that emerged as novel nanomaterials for detecting cancer and transporting pharmaceuticals. However, their applications were rather slow to develop since there is no consensus on nanotube cytotoxicity. Herein, we are investigating the human epithelial cell fate exposed to carbon nanotubes. Specifically, we exposed the cells to varying doses of single- and multi-walled carbon nanotubes. Fluorescence-activated cell sorting (FACS) confirmed nanotube uptake while confocal microscopy showed the once in the cell, the nanotubes associate with elements involved in the cell division processes thus causing cell mutation. The above studies were performed at different nanotube dosage and incubation time respectively. It was found that at low doses there are minimal effects of the nanotubes on the cells while higher doses cause cell proliferation (for shorter incubation time) and cell death for longer incubation time. Our results provide appreciation for the potential problems that carbon nanotubes may pose to human cells and supply the grounds on which we can begin counteracting those effects.

Biological Sciences Category

Bio Sci Poster 7:

Superparamagnetic iron oxide nanoparticles for treatment of diseases

Jamie A. Barr, Peter M. Gannett, Anand Narayanan
Robert C. Byrd Health Sciences Center Department of Basic Pharmaceutical Sciences, West Virginia University, Morgantown, WV

Superparamagnetic iron oxide nanoparticles (SPIONs) can be used to aid in early detection and treatment of diseases, including cancer that accounts for 1 out of every 4 deaths in the United States. Modified SPIONs can be coupled to an antisense agent, which in this study was amino-modified DNA. They can then target, for example, survivin mRNA that codes a protein typically over-expressed in cancer cells. These magnetic nanoparticles may assist with imaging methods, such as Magnetic Resonance Imaging (MRI), for early detection of the location and severity of the cancer. Furthermore, to improve therapeutic treatment, drugs may also be stored and delivered through the coupled SPIONs. Here, polystyrene beads, which are structurally similar to SPIONs, were used in trials to identify the conditions likely to yield the highest number of SPIONs coupled to antisense survivin. Circular Dichroism (CD) and Gel Electrophoresis techniques were used to analyze results for SPION:ssDNA coupling. Wavelength scans using the CD displayed a peak between 260 and 280 nm, revealing the presence of DNA in the coupled polystyrene beads and, subsequently, coupled SPIONs.

Bio Sci Poster 8:

Internal disruption of operant behavior: An investigation of behavioral momentum theory

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Behavioral momentum theory predicts that, in two schedules of reinforcement, resistance to change (i.e., proportion to baseline response rate given a disruptor) will be undifferentiated if reinforcement rates are controlled; however, there is a lack of research investigating this prediction. In the present study, three pigeons were placed on a multiple variable-ratio (VR) yoked variable-interval (VI) schedule during baseline where programmed reinforcement rates were controlled between components. Two types of internal disruptors were examined: variable-time (VT) schedules and extinction (EXT). Each baseline was alternated with a test condition where a VT schedule was superimposed onto both schedules. In the last test condition, extinction was in effect where reinforcement occurred in neither schedule. Resistance to change was expected to be similar between components. Results suggest that behavior under both schedules had similar resistances to change during VT disruption, but behavior under the VR schedule had higher resistance to change during extinction than did behavior under the VI. These findings may have implications for the application of behavioral momentum theory to predict effects of internal disruptors.

Biological Sciences Category

Bio Sci Poster 9:

Huntingtin exon 1's polyglutamine and flanking sequence dependence on lipid disruption

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Huntington's Disease is a neurodegenerative disease that is caused by the expansion of a polyglutamine stretch in the huntingtin (htt) protein. The length of the polyglutamine (Q) expansion correlates with the age of onset. Protein misfolding is caused by the expanded polyglutamine stretch, leading to aggregation of diffuse aggregates like oligomers and fibrils. The toxicity of the diffuse aggregates may depend on the ability to disrupt cell membranes and lipid bilayers. The goal of this study is to explore the interactions between lipid bilayers and htt protein with varying Q-lengths and flanking sequences. We hypothesize the N^{17} region, the first seventeen amino acids at the end terminus of htt, has lipid binding properties that mediate toxic lipid interactions. A variety of mutant constructs of the htt protein with different Q-lengths have been purified. Their aggregation and interactions with model lipid bilayers was determined by Atomic Force Microscopy (AFM). Results, although not yet complete, have shown interactions of htt protein at varying Q-lengths with lipid bilayers.

Bio Sci Poster 10:

Two dimensional electrophoresis separation of coral proteins

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When coral are stressed due to environmental factors such as changes in temperature or water chemistry they lose their symbiotic zooxanthaella, which are responsible for metabolizing energy and their color. When this happens their color is lost and the coral are said to be bleached. The purpose of this experiment was to employ proteomics techniques to indentify changes in protein expression between coral samples that are bleached and unbleached to clarify the cause of bleaching, which eventually leads to coral death. Both bleached and unbleached coral samples were collected by the laboratory of Dr. Andrea Grotolli from The Ohio State University, the bleached had been subjected to increase water temperature. Two-dimensional (2-D) electrophoresis was used to separate proteins via two different properties. First proteins were extracted in a 2-D compatible buffer. Then isoelectric focusing, which was the first dimension of electrophoresis, separated proteins according to pKa values to its isoelectric point. The proteins were then separated by sodium dodecyl sulfate polyacrylamide gel electrophoresis; this separated the protein by molecular weight. Large interferences were caused by salts and DNA which was attempted to be removed via methanol/chloroform/water precipitation, which precipitated the proteins and allowed removal of these contaminants. An acceptable two-dimensional separation was performed and differences in protein expression were observed between bleached and unbleached corals, but the protocol must be altered to separate the zooxanthaella cells from the coral cells. Once the protocol is amended and a suitable separation has been made with the new procedure, the proteins differences will be indentified by liquid chromatography tandem mass spectrometry.

Biological Sciences Category

Bio Sci Poster 11:

Ryanodine receptor subtype expression during the development of the bovine corpus luteum

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Prostaglandin (PG) F2α is the main luteolysin in the bovine corpus luteum (CL). PGF2α initiates a signal transduction cascade, which mobilizes calcium with a consequent increase in the concentration of this divalent ion in the cytoplasm ([Ca2+]i). This increase in ([Ca2+]i) is known to be the intracellular mediator through which luteal progesterone production is inhibited. Intracellular calcium homeostasis is maintained through many mechanisms. One such mechanism is the ryanodine receptor (RyR), of which there are three subtypes. The objective of this research was to determine which receptor is expressed, and if expression is developmentally regulated. To determine the expression of the RyRs, real-time PCR was used to amplify cDNA products from the bovine CL tissues from different developmental stages. The data shows that RyR2 and RyR3 are the only isoforms expressed in the CL. Furthermore, mRNA expression of RyR2 is statistically different between day 4 and day 15, showing an increase with development. Also, a borderline increase was noted between day 4 and day 10, while mRNA expression of RyR3 does not change.

Bio Sci Poster 12:

The Effects of Tolyl-modified DNA on B/Z-DNA Equilibrium

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Aryl hydrazines are known carcinogens and form DNA adducts that drive B-DNA to Z-DNA, which has been implicated in carcinogenesis. Notably, the conversion of B- to Z-DNA results in a twisting motion. Thus, the B/Z-interconversion may have nano-device applications as a switch. Prior work has examined the effect of oligonucleotide sequences that contained two DNA adducts (d (5'-CGCGCG*CGCG-3')$_2$). Here we report on aryl hydrazines derived DNA adducts in hairpin-turn sequences that bear only one adduct, specifically 8-tolyl-2'-deoxyguanosine (5'-CGCGCG*CGCGTTTTCGCGCGCGCG-3') to determine the effect on the B/Z-DNA equilibrium by a single adduct. 8-Tolyl-2-deoxyguanosine was synthesized from 2-deoxyguanosine. The hairpin-turn sequence was prepared using phosphoramidite chemistry and characterized by Nuclear Magnetic Resonance spectroscopy and mass spectrometry. Circular dichroism (CD) was used to measure the B/Z-DNA equilibrium and the data compared to the double stranded DNA (ds DNA) that contained two base modifications. While the equilibrium was shifted toward the B form, relative to the ds DNA, the shift was less than would be expected if the effect of the base modification was additive. (Supported by a REU fellowship to H. J. D. (NSF DMR-1004431), WVU Research Corp & WVU Eberly College of Arts and Science.)

Biological Sciences Category

Bio Sci Poster 13:

The evolutionary impact of environment on tsetse fly (Diptera: Glossinidae) symbiont *Sodalis glossinidius*

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Selection pressures unique to environmental niches drive evolutionary diversification. Endosymbionts are particularly prone to these changes as they adapt to host biology. By examining hypervariable genes encoding surface-associated proteins, we aim to assess divergence and expression among *Sodalis glossinidius*, the secondary symbiont of the tsetse fly (Diptera: Glossinidae), isolated from culture and various host species. We hypothesize that long-term environmental differences (i.e. a long term *in vitro* compared to *in vivo* symbiont establishment) result in genome evolution. Seven *Sodalis* genes encoding outer membrane proteins were identified (i.e. *omp*A, *spr*, *sly*B, *rcs*F, *ycf*M, *omp*C, and *ams*H), amplified through PCR, and subjected to DNA sequencing. Furthermore, the *omp*A gene was cloned and sequenced to assess symbiont diversification within and between host individuals. Neighbor joining, maximum parsimony, and Bayesian analyses were performed, and consensus phylogenetic trees were constructed. Through reverse transcription PCR, the expression of surface encoding genes are compared using *in vitro* and symbiotic *Sodalis* RNA isolates. Results indicate genetic divergence among *Sodalis* isolates, demonstrating the evolutionary impact of host-symbiont interactions towards genome differentiation.

Bio Sci Poster 14:

Assessment of selection on cellulose synthase–like genes and germin-like genes in *Populus trichocarpa*

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The wood of *Populus trichocarpa* (black cottonwood), a deciduous tree in the Pacific Northwest, is a potentially useful source of biofuels. This has spurred the identification and characterization of genes involved in the synthesis and maintenance of the cell wall, the largest component of its biomass. The sequencing of the *Populus trichocarpa* genome illustrated that the entire genome duplicated approximately 65 million years ago. From this whole-genome duplication, 15,000 of *Populus trichocarpa's* approximately 45,000 genes were preserved as paralogous pairs. In this study, two gene pairs involved in cell wall biosynthesis, a cellulose synthase-like gene pair and a germin-like gene pair, were assessed for evidence of selection. Fragments from these genes were sequenced using Sanger technology, and evaluated for single nucleotide polymorphisms (SNPs). Low levels of polymorphism in the cellulose synthase-like genes may be indicative of a selective sweep, but this lack of variation precluded other tests. In contrast, the germin genes are more polymorphic, and we will test for signatures of selection based on patterns of linkage among loci and rates of nucleotide substitution.

Biological Sciences Category

Bio Sci Poster 15:

Examining the effects of ampicillin toward tsetse fly (Diptera: Glossinidae) endosymbionts

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Tsetse flies (Diptera: Glossinidae), the sole vectors of fatal African trypanosomes (*Trypanosoma brucei* subspp.), harbor two enteric bacterial endosymbionts which are critical to their biology. The two endosymbionts with known functional roles are the primary obligate mutualist, *Wigglesworthia glossinidia* and the secondary mutualist, *Sodalis glossinidius*. Both are vertically transmitted to progeny via maternal milk gland secretions. This study aimed to alter the endosymbiotic flora within tsetse through antibiotic supplemented blood meal diets. Species-specific PCRs were performed to determine the presence of both symbionts. Tsetse pupae were collected from three distinct mating lines and the effects towards symbiont densities and various tsetse life history traits were measured. Interdependencies between symbiont populations were examined and the effects of disrupting symbiont populations on tsetse life history traits are described. The tsetse fly is a medically significant model of symbiosis, and by developing ways to alter their endosymbionts novel mechanisms of vector control may also be discovered.

Bio Sci Poster 16:

Classification of epidermal bacteria via 16S rRNA clonal analysis for forensic human identification

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There is a need in forensics for identification of individuals through methods other than fingerprinting and DNA analysis. Fingerprints and DNA are not always available, and other methods of identification would prove useful. The idea behind this research is that all individuals have their own unique composition of bacteria—"bacterial fingerprint"—on their epidermis that differs for each individual. In this study, the fingers and palm are analyzed for their bacteria. In order to classify the bacteria collected from the palm of an individual, a highly conserved region of bacterial DNA called the 16S rRNA gene is analyzed. Polymerase chain reactions (PCR) are used to amplify the 16S rRNA gene. The bacteria are identified by comparisons of the replicated gene to known bacterial 16S rRNA sequences. Through classification of bacteria via the 16S rRNA region of DNA, an individual can be identified without fingerprint or DNA analysis. Bacteria have successfully had the DNA extracted and purified. PCR protocols are undergoing optimization so that sequencing may proceed.

Biological Sciences Category

Bio Sci Poster 17:

Characterizing single stranded binding protein interactions with SSDNA using Single Molecular Force Spectroscopy

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Force spectroscopy is a dynamic analytical technique that allows the study of the mechanical properties of single polymer molecules or proteins, or individual chemical bonds. It is performed by pulling on the system under scrutiny with controlled forces. As a single-molecule technique it allows a researcher to determine properties of the particular molecule under study. In particular, rare events such as conformational change, which are masked in an ensemble, may be observed. Single stranded binding protein (SSB) is utilized by cells during DNA replication to prevent separated strands of DNA from annealing due to the high affinity of the corresponding nucleotides. For this experiment the force required to separate a bound SSB protein from a single stranded DNA molecule will be tested under various salinities. The PEG linkers are vital to providing approximately twenty nanometers of distance between the molecules and their respective surfaces. This will prevent the molecules from interacting with their substrates and help to ensure that the force measured is solely from the binding properties.

Bio Sci Poster 18:

Mixed Messages Sent During Parent-Adolescent Communication Regarding Tobacco Use

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The importance of communication between parents and adolescents is well known, especially on significant issues such as tobacco use. However, less research has examined the specific content of parental messages about cigarette use. Current measures concentrate on parental disapproval of smoking and do not tap potential complexities in parental messages such as parents who mention potential positive aspects of smoking (e.g., enjoyment). The aim of this study was to examine the content of messages that parents and adolescents are sharing when discussing cigarette use. Specifically, this study looked at instances when parents and teens not only talked about the harmful effects of cigarette smoking, but also aspects that they or others enjoy about tobacco use. These complex messages include characteristics such as liking certain aesthetics of cigarette use, general enjoyment of smoking, and feeling relaxed when smoking a cigarette. This research was completed after developing a coding scheme that was used to examine videos of parent-adolescent communication about tobacco use. The data collected from the coding scheme was then analyzed against demographic and personal information collected from the participants in order to further understand the significance of mixed messages exchanged between parents and adolescents regarding tobacco use.

Biological Sciences Category

Bio Sci Poster 19:

An Analysis of the Efficacy of Cationic Antimicrobial Peptides

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2 Department of Biology, West Virginia University
3 WVNano Initiative, West Virginia
4 Department of Chemical Engineering, West Virginia University

In 2009, the CDC reported a sharp rise in the number of severe bacterial infections, especially those caused by *Staphylococcus*. We, therefore, undertook a novel approach in treating bacterial infections with cationic antimicrobial peptides (CAMPs). In our *in vitro* study, a clinical strain of *S. aureus* (1004) obtained from a patient's chronic wound at Ruby Memorial Hospital and an ATCC strain (25923) were treated in their log phase with the CAMPs, Cathelicidin LL-37 and Lactoferricin-B, and were compared with the efficacy of Cefazolin, a common conventional antibiotic, under the same experimental conditions. Our results indicated that CAMPs are highly potent in eliminating the bacteria compared to Cefazolin, and among the two CAMPs, LL-37 was extremely potent in killing over 90% of the bacteria at a very low molar concentration (250 nM). By contrast, Lactoferricin-B and Cefazolin reported over 90% killing at 25 µM and 1.0 mM, respectively. Due to its robust bacterial killing efficacy, even at nanomolar concentrations, LL-37 can be pivotal in developing localized target precision drug delivery systems in the near future.

Bio Sci Poster 20:

Mathematical Analysis of Separation of Small Particles using Traveling-Field Type Electric Curtain Device

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An investigation of size and charge dependent separation of small particles in a viscous fluid using a traveling-field type electric curtain device is conducted. The study of this procedure has potential applications in molecular biology, genetics, bioengineering, proteomics and other related fields. Modeling of the electric potential is done using Fourier series analysis. Computer simulations are used to model single particle trajectories using a Fourth Order Runge-Kutta procedure. Focus is on the dependence of particle trajectories on electrophoretic mobility. In particular, close attention is paid to the transition between different modes of particle motion in different mobility regimes. Results are compared with those of Masuda et al. This work will lead to a better understanding of particle transport in a time dependent non-uniform electric field.

Agricultural and Environmental Sciences Category

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Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 1:

Measurement of leaf macro-and micro- nutrients through reflectance spectroscopy

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The chemical make-up of deciduous and coniferous leaves is known to differ among species and along environmental gradients, but measuring these inter-specific and spatial differences currently requires many separate and time-intensive chemical analysis. Reflectance spectroscopy presents a possible way to measure many chemical attributes from a single rapid measurement. With the use of an ASD Fieldspec Spectrometer fitted with powdered sample measurement apparatus, we measure spectral reflectance on dried ground leaf tissue obtained from nine tree species located across the broad environmental gradients of the Adirondack Park, NY. We used partial least squares regression to relate these reflectance measurements to the conventional laboratory measurements of multiple foliar elements. The statistical relationships from our dataset indicate that reflectance spectroscopy is only moderately successful in predicting spatial and inter-specific variability for some foliar micro-nutrients (e.g. Mn, Al), but is a highly accurate and time-saving technique for assessing the inter-specific and environmental variability of several key foliar macro-nutrients (e.g. N, Ca).

Ag & Env Sci Poster 2:

. The role of lysyl oxidase in the catabolism of lysine in pig tissues

John T. Barnard* and Kenneth P. Blemings
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Lysine is an essential and often limiting amino acid in diets of agriculturally important species. Therefore, research in lysine catabolism could potentially increase the efficiency of animal production. Lysyl oxidase is responsible for catalyzing the final known step in the biosynthesis of normal extracellular matrices. Due to the limited information available on the catabolism of free lysine by lysyl oxidase, we sought to characterize the tissue distribution of enzyme activity. The study assessed lysyl oxidase activity in growing pigs (n=5) in liver, heart, renal medulla and cortex, enterocytes, triceps and longissimus. Lysyl oxidase activity was measured fluorometrically as the β-aminopropionitrile inhibitable H_2O_2 production via a coupled reaction with horseradish peroxidase. Activity was detected across all tissues studied; however, muscle tissues (heart, triceps, and longissimus) exhibited significantly higher activity presumably due to the increased requirement for extracellular matrices in these tissues.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 3:

Identification of Steroid Concentrations in *Sungnathoides biaculeatus* with Capillary Electrophoresis

Tiffany R Dolan, Stephanie Archer-Hartman, Jana Woofter, Lisa A. Holland
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Pollution affects large populations living along rivers and other sources of water. Environmental sentinels, *Sungnathoides biaculeatus* (pipefish), are used to identify endocrine disruptors resulting from the pollution. Endocrine disrupting compounds vary in both identity and physiological effect. Circulating steroids are biomarkers of endocrine disruption. Capillary electrophoresis is an automated separations technique that allows for quick analysis of low sample volumes for the determination of steroid concentrations in fish plasma. Steroids are concentrated using pH-mediated stacking and separated using a variation of capillary electrophoresis called micellar electrokinetic chromatography (MEKC). MEKC is a method for separating neutral compounds through attraction to the non-polar interior of micelles that migrate through the capillary. Calibration curves of 17α,20β-dihydroxypregn-4-en-3-one, testosterone, 11-ketotestosterone, and 17β-estradiols are linear for concentrations ranges of 250 nM to 1,000 nM, with correlation coefficients ≥ 0.996. The relative error in migration time is ≤ 0.1 % (n = 3). This stacking and separation procedure is used to measure circulating steroids in pipefish tissue.

Ag & Env Sci Poster 4:

Hyporheic Characterization of a Headwater Catchment

Amelia M. Snyder and Nicolas P. Zegre
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The hyporheic zone plays a critical role in ecosystem processes such as biogeochemical cycling, stream temperature regulation, and flood control, but is poorly understood in the Mid-Atlantic region of the Appalachian Mountains. In order to fill this knowledge gap, hydrologic processes were studied in a headwater catchment located in Coopers Rock State Forest, WV. In-stream hydrologic and hyporheic processes were characterized by conducting a salt slug tracer and steady state tracer using Rhodamine as an optical tracer. The results were used to identify groundwater and hillslope water contributions to streamflow, in-stream velocity, and ultimately to parameterize a one-dimensional solute transport model to estimate hyporheic storage and residence time. Preliminary results from this study show longitudinal microdilutions, indicative of an increase in streamflow due to hillslope water contributions. This increase in discharge is beneficial to the stream's ecosystem because it provides a source of new nutrients coming into the stream as well as decreases stream temperature.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 5:

Effects of forest edge on American ginseng pollinator activity and identity

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Fragmented ecosystems have a higher proportion of edge exposed areas which experience potentially deleterious abiotic and biotic changes. As suburbanization in Appalachia increases, these 'edge effects' are becoming of greater concern. This study investigates how proximity to anthropogenic edge impacts American ginseng (*Panax quinquefolius* L.), an annually harvested plant species in the region, by quantifying the number and type of pollinators that visit ginseng as a function of distance from the forest edge. Flowering American ginseng plants were planted in transects at logarithmically increasing distances from anthropogenic edge at three sites. Transects were observed for a total of 19 hours over four weeks to quantify pollinator activity. Distance from edge did not have a significant effect on pollinator activity ($p=0.8103$). However, Syrphid flies were the predominant pollinator active in the transects closest to the edge while Halictid bees were predominant in transects closer to the forest interior. Due to differences in quantity of pollen carried by these two groups, this pollinator guild shift could impact the genetic structure of American ginseng populations in edge proximate areas.

Ag & Env Sci Poster 6:

Comparison of amphibian populations and water quality against wetland rapid assessment scores

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A rapid assessment technique has been developed to evaluate the quality and function of wetlands in West Virginia. The assessment was designed to measure a variety of both abiotic and biotic factors that, when combined, can be used to calculate individual wetland scores. These rapid assessments are used to evaluate a wetland in terms of vegetation community structure, substrate, human impacts, and other similar factors. However, they do not directly assess the quality of habitat for wildlife such as amphibians. Consequently, we have designed our research project to determine how effective the score is in reflecting an area's habitat value by comparing the numbers of captured amphibians (frogs, toads, salamanders, newts) and a few basic water quality measurements against the assigned scores. The water quality measurements we have chosen to take include dissolved oxygen, pH and temperature. Results will be discussed.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 7:

Changes in soil respiration across a nitrogen deposition gradient: Evidence from high elevation red spruce (Picea rubens) forests in central Appalachia

Ben Hedin, Kenneth Smith, Richard Thomas
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High elevation red spruce (*Picea rubens*) sites in central West Virginia constitute a unique ecosystem for the Appalachian Mountains. These forests are home to rare plants and wildlife, including the Northern Flying Squirrel and Cheat Mountain Salamander. Given the close proximity of these forests to coal-fired power plants, high rates of nitrogen deposition have occurred leading to a recent decline in red spruce growth and productivity. Soil respiration is an important component of forest productivity; thus, it is of considerable interest to understand how soil nitrogen status affects carbon flux. We measured soil respiration along a nitrogen deposition gradient in three red spruce forests in West Virginia over 6 weeks using an automated soil CO_2 flux system (LI-8100). Soil CO_2 flux measurements were then correlated with field measurements of instantaneous temperature and soil moisture to develop a significant relationship between these variables. Using this relationship, soil respiration can be extrapolated from continuous data-logged temperature measurements in the field thereby providing a useful model of annual soil flux.

Ag & Env Sci Poster 8:

The distribution of ergot alkaloids in seeds and seedlings of *Ipomoea tricolor*

Corey S. Hazekamp, Christopher T. Moore, and Daniel G. Panaccione
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Seeds from several morning glory species (Convolvulaceae family) contain high concentrations of ergot alkaloids. It has been proven recently that symbiotic fungi of the family Clavicipitaceae, rather than the plants themselves, synthesize these ergot alkaloids. Ergot alkaloids in vegetative tissues of *Ipomoea tricolor* (the common garden morning glory) have not been well characterized. Ergot alkaloids typically play a protective role, but their function in morning glories is unknown. We investigated the distribution of ergot alkaloids in different tissues of seeds and developing plants and whether this was affected by fungicide treatment. HPLC analyses showed that alkaloids were primarily in the axis of germinating seeds and had low concentrations in seed coats, suggesting that the alkaloids are not protecting the seed. Young seedlings quickly redistributed ergot alkaloids previously stored in the seeds to the roots. Fungi in above ground tissues resumed alkaloid synthesis shortly after germination, but concentrations in these tissues were lower than in young roots. The data suggest that ergot alkaloids stored in seeds may have a role in protecting roots of seedlings.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 9:

Effects of soil acidification on growth leaf composition, and herbivory in *Prunus serotina* and *Acer rubrum*

C. Greer, W. Peterjohn, Z. Fowler, S. Finkel, A. Lloyd, and P. Cress
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Acid rain that results from the burning of fossil fuels may induce soil acidification in forest ecosystems. Nitrogen and sulfur in the forms of nitric acid (HNO_3) and sulfuric acid (H_2SO_4) are the primary contributors to the acidification process, which removes base cations from the soil, depleting essential nutrients. However, nitrogen from acid rain can also act as a fertilizer to stimulate plant growth. To assess the net impact of acid rain on the growth of important Appalachian hardwoods, this study uses measurements taken from the Long Term Soil Productivity plots on Middle Mountain in West Virginia. All plots were cut in 1997 and have been regularly treated with the intent of simulating the effects of acid rain in an accelerated fashion. This study investigates the effects of the treatments on *Prunus serotina* and *Acer rubrum* using measurements of tree growth and leaf properties including: chlorophyll content, percent nitrogen and carbon, and percent leaf area herbivorized. Experimental results are pending.

Ag & Env Sci Poster 10:

Table Mountain Pine (*Pinus pungens* Lamb.) Regeneration in Association with Fire History at Pike Knob, WV

Joshua R. Ash, Joshua A. Wixom and Amy E. Hessl
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Pinus pungens is a small scrub pine native to the Appalachian Mountains. Although not completely serotinous, regeneration of this species is associated with disturbances such as fire. Age structure was investigated within an isolated community of *Pinus pungens* along a sandstone ridge at Pike Knob, WV. The site has experienced fire suppression since the 1920s which may have altered regeneration. By examining the age structure of the *Pinus pungens* stand we can analyze the regeneration of the species during a period without fire. A detailed fire history study from a nearby red pine (P. resinosa) site was used to compare known fire dates with periods of *Pinus pungens* regeneration. In the field, a belt transect was located along the cliff edge to serve as a baseline and four 40m transects were spaced 20m apart. Two increment cores were collected from trees at 4m intervals along each transect (n = 40 trees). Following standard dendrochronological practices, cores were mounted, sanded, and visually crossdated. As hypothesized, tree regeneration appears to be limited after 1930 following fire suppression. Additional results from the study will be presented.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 11:

Detrital processes in streams across a conductivity gradient in an intensively mined watershed

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Mountaintop removal/valley fill (MTR-VF) mining causes changes in water quality that affect all trophic levels of stream communities. Decomposition is a crucial process of stream function, and ergosterol levels and community respiration rates in decomposing leaf litter have been used as indicators of decomposition. The extent to which MTR-VF mining affects these processes is largely unknown. The objectives of this study were to: 1) compare ergosterol levels, respiration rates, and macroinvertebrate community structure across a range of conductivities in the Coal River watershed, WV; and 2) use ergosterol and respiration data to compare the leaf pack data collection method with a grab sample method. Conductivities ranged from 130 μs/cm to 3708 μs/cm, and Ephemeropteran diversity declined significantly across that gradient. Ergosterol levels and community respiration rates showed a general decrease with increasing conductivities and varied between the two sampling methods, but patterns among test sites could be discerned. This study provides insight into the effects of MTR-VF mining on stream detrital processes and provides support for a rapid assessment technique quantifying ergosterol and community respiration.

Ag & Env Sci Poster 12:

Developmental gene expression of voltage-gated calcium channels in the bovine corpus luteum

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Progesterone (P4), secreted by the corpus luteum (CL), is essential for pregnancy. In the absence of pregnancy, prostaglandin F2-alpha (PGF2α) induces regression of the CL (luteolysis). Synthetic PGF2α is administered to induce luteolysis and subsequent ovulation for artificial insemination in heifers. However, PGF2α is ineffective before the CL fully develops. It has been established that Ca^{2+} is the major intracellular mediator of the luteolytic actions of PGF2α. PGF2α elicits a Ca^{2+} signal of greater magnitude in luteal cells collected on day-10 than on day-4. Voltage-gated calcium channels (VGCC), mediators of Ca^{2+} influx, were examined with the objective of elucidating their possible role in rendering the early CL resistant to PGF2α. mRNA expression for T-, N-, and L-VGCC in CL tissue collected on days-4, -10, and -15 was determined by real-time RT-PCR. Data indicated that only N- and L-VGCC are expressed in the bovine CL. After statistical analysis of mRNA of L- and N-VGCC, this data does not support that VGCC participate in the resistance of the early CL to the luteolytic actions of PGF2α.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 13:

The effects of Resveratrol on heart rate during moderate exercise in aged quarter horse geldings

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The horse has incredible athletic capability, due to substantial lung capacity and ability to increase cardiac output with training. Resveratrol, a phytocompound, is quickly becoming known for its favorable health effects which include acting as both an anti-inflammatory agent and antioxidant. One of the proposed health benefits is lowering heart rate during oxidative stress, and therefore the purpose of this study was to observe how Resveratrol affects heart rate during moderate exercise. For this study, a randomized crossover design was executed utilizing three two week dosage periods with a one week washout period. Six aged geldings (10±2 years, 535±75 kg) were randomly divided into three groups, which included control, low dose (2.5 g/dose) and high dose (5 g/dose). A standardized exercise protocol of moderate intensity for sixty minutes was implemented three times a week within each two week collection period. During that time each gelding wore a heart rate monitor (Polar equine, RS800CX, Kempele, Finland) and were asked to reach target heart rates as described by the National Research Council. At this point, data is still being collected and analyzed, thus we have no concrete conclusions. Funding was provided by the West Virginia University Faculty Senate Grant.

Ag & Env Sci Poster 14:

Optimal photoautotrophic growth and lipid quantification of Chorella vulgaris

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Unicellular green algae contain lipids which can be extracted and used for the production of biofuels; therefore, culture conditions producing maximum biomass are of interest. Chorella vulgaris easily can be grown, maintained, and manipulated in a laboratory setting. This alga was cultured in Tris phosphate media under conditions of varying light (100-600 µmol photons m^{-2} s^{-1}), and CO_2 (0.03%-12%) to test for optimal photoautotrophic growth environments and that maintain a greater lipid content than the control. Lipids were quantified by colormetric detection using a protocol described by Boris Wawrik and Brian H. Harriman, 2009. Cells were grown over a 4-6 day period at 25°C in photobioreactors of varying design. Direct microscopic counts, optical density measurements, and photosynthetic activity determinations were performed daily. Chorella vulgaris exhibited maximum growth in Tris at pH 7 using 6% CO_2, and 300 µmol photons m^{-2} s^{-1}.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 15:

The Affect of Gravel Content, and Moisture content of Soil, on the Risk of Compaction

Thomas Hughes, Joshua Hall, E. Pena-Yewtukhiw
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Winter grazing is a common practice in West Virginia. It is believed that this practice degrades the physical soil conditions and affects the sustainability of the environment, and production system. The most common process of soil degradation associated with winter grazing is compaction. It is believed that favorable conditions for soil compaction are common during the winter months. Soil conditions such as moisture content and fine soil texture affect the degree and risk of compaction of a soil. We hypothesize that because Appalachian soils have high gravel content, it may resist compaction due to animal grazing under unfavorable weather conditions (winter humid conditions).

This study was conducted to determine the effect of gravel content, and moisture content on the risk of compaction of the soil.

The Standard Proctor Method was used to perform the compaction. The observations indicated that as moisture content and gravel content in soil increased, the risk of compaction decreased. The risk of compaction at moisture levels of 20%, 30%, and 40% decreases rapidly as gravel content is increased.

Ag & Env Sci Poster 16:

Bio-Organic Agriculture Systems: Residual Effects of Fertilization Treatments on Soil Quality and Vegetative Cover

Erica M. Fitzsimmons , Dr. Eugenia M. Pena-Yewtukhiw
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Soil and plant properties in organic agricultural systems depend heavily on the treatments and care of residual agricultural land. In this experiment, our aim was to determine some soil properties of organic farm plots with various known levels of fertility treatments over a span of ten years, and also to explain amount of vegetative cover in relation to the fertility treatments. Measurements of plant and soil biomass, ground cover (.30m x .33m quadrat), bulk density were taken in 25 small plots (1.4m x 2.4m) which had five levels of soil compost treatment applied at random. By analyzing the results relationships between the fertility levels with biomass and bulk density were clear. Plant biomass increased as the fertility level increased, ranging from an average of 10 grams for the lowest fertility level to an average of 39 grams for the highest fertility level. Soil bulk density, however, decreased with increasing fertility levels. The average bulk density for the lowest fertility level was 10.36 g/mL and 9.47 g/mL for the highest fertility level. A trend was also observed relating more plant ground cover to higher fertilities. Furthermore, these results suggest that plant biomass (growth) is most prominent in highly fertile soils, yet the bulk density decreases with higher fertility levels, due to varying soil properties in the five different fertility levels.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 17:

Effect of the feed mold binder Zar-min on Capsaicin Oil

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In a recent study by one of Dr. Krause's PhD students, Lisa Tager, the effects of capsaicin oil on the feeding patterns of cows were tested. They hypothesized that the capsaicin oil, which has a hot taste like a pepper, would cause the cows to eat a smaller amount of food each meal and also have more frequent meals which is advantageous for rumen digestion. This however did not happen. The feeding patterns did not change and one possible explanation was the compound Zar-min. Zar-min is an anti-molding chemical that is added to feeds to preserve the feed and prevent molding over time. We wanted to find if the Zar-min reacted or bounded with capsaicin oil. Capsaicin oil in the bottle is a thick viscous compound composed of different isomers. Our first task was to dissolve the capsaicin oil and run it through the spectrometer at 227nm to understand the exact chemical characteristics of the oil which helped to determine what characteristics of the compound could be reacting with the Zar-min, which chemical make-up was known. Next an assay was created containing various amounts of Zar-min ranging from 0.16 to .42g. The capsaicin was dissolved in ethanol to the correct concentration that appeared on the spectrometer and was then poured over the Zar-min assay. If the capsaicin oil bound to the Zar-min, Lisa Tager's experiment would not be sound. Zar-min was added to the feed in the experiment in very minute concentrations, less than 1g per 200kg of capsaicin oil. 4.6mL of capsaicin oil solution was poured over 0.16g of Zarmin and 100% of the oil was recovered which meant that Zar-min did not bind and was not the cause of the disappointing results.

Ag & Env Sci Poster 18:

Survival of Listeria innocua after Isoelectric Solubilization and Precipitation of Fish Protein

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A large percent of fish protein is lost during commercial processing because the tissue is attached to the heads and frames is often discarded. This tissue can be recovered by the process of isoelectric solubilization and precipitation. This process solubilizes protein through severe changes in pH, precipitation, and centrifugation. Previous studies have shown a decrease in microbial survival after this process. The greatest change in microbial presence was shown with pH 3 acetic acid. In this study, headed and gutted rainbow trout were innoculated with L. innocua, homogenized, and brought to the target pH of 3 by addition of glacial acetic acid or sodium hydroxide. The fish protein was solubilized at the target pH (3) for 10 minutes at 4C., centrifuged, and the lipid and insoluble compenents were respectively separated from the protein and water. The remaining protein was solubilized, brought to its isoelectric point(pH 5.5) and again homogenized for 10 minutes at 4C. The sample was then centrifuged and the water and protein separated. Each component(lipid,water,protein,insoluble) was analyzed using both a growth(TSAYE .6%) and selective(MOX) media.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 19:

Use of expression cassettes in *Agrobacterium tumefaciens* to increase transformation rates in legumes

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Legumes are characterized by low transformation rates due to a large amount of metabolic energy, inefficient embryogenesis efficiency, negative response to harmful agents, and large levels of cell death induced by plant systems. Through the use of PCR, gel purification, digestion and ligation of selected plasmid vectors, and gene cassettes, this study seeks to create an expression system that will eradicate these problems faced by researchers. The laboratory created vector is expressed with a pCambia 1305.2 backbone. This binary vector has proved to be a highly efficient expression backbone. Additionally, the promoter is changed from 35S to a light inducible promoter. The final clone contains a selection agent that induces imazapyr resistance. A dexamethisone inducible system was introduced to this vector as well. The gene of interest will only be expressed in an inserted gateway system when this steroid is sprayed on the plant. So far, only the light inducible promoter and the imazapyr resistance gene have been successfully transferred to the backbone. The changes made to these genes will be tested first on tobacco leaves as well as other legume crops.

Ag & Env Sci Poster 20:

A computational study of the absorption properties of SPEA

Neil A. Bowman, Shichao Wang, and Shimei Jiang
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Chemosensors are highly sensitive and selective sensors that can be used to detect anions, cations, or neutral analytes. These sensors can serve for a variety of applications, some of which include biological probes, environmental sensors, or molecular devices. The particular chemosensor being studied involves the molecule SPEA and can serve as a “naked eye” sensor for CN^- and F^- anions. The addition of CN^- or F^- anions produces a unique absorption spectrum that can be used for detection. A computational study of the various structures of SPEA was performed to validate the experimental results. Time-dependent density functional theory (TD-DFT) calculations were performed using the Gaussian 09 package to produce theoretical absorption spectra. There were five structures studied that can form based on the solvent the molecule is dissolved in and also the anion that is present. Matching theoretical results were obtained for three of the five structures studied, however; results for the remaining structures are unconfirmed.

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Physical Sciences and Engineering Category

Phys Sci & Eng Poster 1:

Application of natural convection for thermal management of a building structure

Jeffrey W. Conrad, Dr. Emily D. Pertl and Dr. James E. Smith
College of Engineering and Mineral Resources, Center for Industrial Research Applications, West Virginia University, Morgantown WV

The addition of a second layer roof with chimney causes convective air flow to be generated which serves as a solution to reducing the heat transferred into the structure. Reduction of heat on the roof results in less heat buildup in the attic and consequentially the building structure. With the ever increasing cost of energy, this serves as a way to save money on air conditioning in the hot months. In addition, the extra layer of insulation between the two roofs will also save on heating costs in the colder months. The top layer roof is constructed of a material that allows heat to be conducted through the surface to the layer of air between the two roofs causing the air to heat up. This reduces its density and draws the air up through the chimney located at the ridge. This process causes an air movement resulting in temperature reduction of up to 30 degree Fahrenheit on the shingled roof surface. A scaled unit with a shingled roof and a second unit with the add-on roof feature are used to experimentally validate predictions using temperature and air speed sensors. Computer aided design and thermal analysis are also used to compare to the experimental findings. The results indicate that the top layer roof causes the shingled roof temperature to decrease. This in turn causes the attic temperature to decrease resulting in reduced energy prices for the structure.

Phys Sci & Eng Poster 2:

Synthesis of a low band gap small molecule for use in photovoltaic devices

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Current solar cells achieve only ~7% power conversion efficiency at best. This study was conducted in an attempt to increase this efficiency through the synthesis of an effective e^-/exciton donor component for the active layers of such cells, 2,2'-(5,5'-(1E, 1'E)-2,2'-(benzo[c][1,2,5]thiadiazole-4,7-diyl)bis(ethane-2,1-diyl)bis(3,4-didodecylthiophene-5,2-diyl))bis(methan-1-yl-1-ylidine)dimalononitrile (BTDM). General organic synthesis methods were employed in the engineering of the goal molecule, including the following: Grignard reaction, Wittig reaction, Shapiro reaction, Mizoroki-Heck reaction, reaction with butyllithium, and Knoevenagel condensation. UV-vis spectrophotometry was then performed on the final product to determine absorption. HNMR and TOF mass spectrometry results show that BTDM was successfully synthesized, but that sufficient purification still remains problematic. The absorption spectrum exhibits excellent overlap with the terrestrial solar spectrum, indicating that there is great promise for BTDM as an effective donor component for the active layer of solar cells. Further research must be done to determine electrochemical properties, such as HOMO and LUMO energy levels, and effects on photovoltaic device performance.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 3:

Computationally Determining Forces on Molecules in Local-Orbital Density-Functional-Theory Tight-Binding Method

Scott Ferris*, Dr. James Lewis*, Barry Haycock**, Oleg Prezhdo***, Sean Fischer***, Tammie Nelson***

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*** Dublin Institute of Technology*

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Based off the long standing idea of obtaining forces on molecules by deriving the total energy there have been many successful efforts toward developing the idea of using computational methods to determine total energies and forces which includes application to molecular-dynamic systems. Exact forces are obtained by taking the derivative of elements with respect to position within density and energy density matrices that are complied by interpolation based on data structure positions during the molecular-dynamic simulation. The forces have components of band-structure, short range repulsion, and the exchange-correlation which have varying effects based on structures used. Over the years methods of approximation surrounding computing energies have improved significantly, one such case is the code FIREBALL devolved in part by Dr. Lewis whose group is now seeking to modify these computational techniques once again to a faster, more efficient yet strikingly similar code aptly named LIGHTNING. My work involves developing a file to read density matrices and derive elements to obtain the forces in LIGHTNING.

Phys Sci & Eng Poster 4:

Selective micropatterning of polymer wettability and topography for water collection

Matthew A Payne and R Lloyd Carroll

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Natural draft cooling towers are used to condense and recycle water back into the cooling systems of power plants, but a large amount of water is still lost in the form of plume discharge. This project is focused on the investigation of polymer alterations, with the objective of developing a manufacturing process for a material that could passively and efficiently gather additional water from inside these towers. The ultimate goal is the creation of a topographic surface with alternating hydrophilic and superhydrophobic regions arranged in micropatterns. A variety of procedures are being employed including chemical modification of wettability, plasma oxidation for etching and surface activation, and polydimethylsiloxane (PDMS) microcontact techniques for selective pattering. Resulting surfaces are analyzed by methods such as optical microscopy, infrared spectroscopy, atomic force microscopy, and x-ray photoelectron spectroscopy. Promising results have been obtained in the areas of polymer plasma treatment, PDMS molding and subsequent use for patterning, and chemical and topographic surface alteration.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 5:

Tuning the optical setup for femtosecond Coherent anti-Stokes Raman scattering microscopy

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Coherent anti-Stokes Raman scattering (CARS) microscopy is a non-invasive technique to image living specimens. Using optical elements, three infrared laser beams are combined and sent to a microscope. The combined beam causes the specimen to vibrate and create an image based on its chemical bonds. In constructing a CARS optical setup, the table must be fine-tuned and aligned perfectly. In particular, the micrometer, which holds the dichroic mirror where the beams meet, and the angle of convergence (AOC) must be tuned to give the highest voltage. The maximum voltage of the micrometer is found by tuning the device in millimeter intervals. The AOC is then changed by increments of 1° until the highest voltage is achieved. It was found that the maximum voltage for our optical setup is observed when the AOC is 5°and the micrometer reads 4.895cm. Tuning this area of the optical setup allows the converged beam to carry the most available energy on its path to the microscope allowing the best possible CARS image to be produced.

Phys Sci & Eng Poster 6:

Characterization of indium gallium nitride LEDs for biosensing and illumination applications

Benjamin A. Bearce, John Dudding, Ronak Rahimi, Vamsi K. Kumbham, Rohit Goswami, Sridhar Kuchibhatla, Srinitya Musunuru, Kyoungnae Lee, Lee Rodak, Dominic Gutierrez, Dimitris Korakakis, Lawrence Hornak
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Efficient integrated optical sources are essential for numerous applications including next-generation high efficiency lighting and integrated optical biosensor detection systems based on whispering gallery modes (WGMs). This work describes the characterization of Light Emitting Diodes (LEDs) developed as basic building blocks for both these applications. The LEDs are comprised of an active layer of InGaN/GaN quantum wells between p and n-type layers of GaN. The base device has a peak emission wavelength of 460nm and emission FWHM of 38.2nm. Characterization efforts seek to establish the consistency necessary for comparisons across devices to yield significant changes in the design process. Using a semiconductor parameter analyzer, a set of discrete I-V curves were generated for indium gallium nitride (InGaN) LED devices with a sweeping voltage input. From this data, device parameters of the LEDs can be determined including the turn on voltage (V_Y) and the internal resistance (R_f). Optical output spectra of the LEDs are obtained using a CCD Array Spectrometer. Characterization results will be presented in addition to methodologies developed for extraction of important device parameters.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 7:

Separation of fluorescently-labeled glycans by microchip electrophoresis

Autumn J. Bullard[1], Christian M. White[2], Lisa A. Holland[2]
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Carbohydrates play an important role in biological functions. The ability to analyze carbohydrates can provide a deeper insight into their physiological role in biological systems. Microchip electrophoresis is a technique capable of analyzing carbohydrates. Microchip electrophoresis embodies the same concepts as capillary electrophoresis, but it is less expensive while offering increase portability and rapid analyses. In the work presented here, microchip electrophoresis is used to separate a five member maltooligosaccharide ladder under normal and suppressed electroosmotic flow conditions. The electroosmotic flow was suppressed using a phospholipid coating comprised of 1,2-dimyristoyl-*sn*-glycero-3-phoshocholine (DMPC) and 1,2-dihexanoyl-*sn*-glycero-3-phoshocholine (DHPC). The phospholipid coating also decreases the analyses time by 40%. The oligosaccharide ladder was derivatized with the fluorophore 8-aminopyrene-1,3,6-trisulfonic acid to facilitate detection using a CCD camera coupled to a Nikon TE300 inverted fluorescence microscope. The approach demonstrated here can be adapted to separate glycans obtained from glycoproteins through enzymatic cleavage. It can also be adapted to monitor enzymatic processes in real-time.

Phys Sci & Eng Poster 8:

Eye detection in the mid-wavelength infrared spectrum

Zain Jafri and Thirimachos Bourlai
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The performance of a face recognition system is favorably affected by the geometric normalization of raw face images. The main criterion to achieve this is to extract the eye coordinates of each face. While currently there are automatic methods to perform such a task in the visible and active infrared spectrum, in the mid-wavelength infrared spectrum (MWIR), it can only be done manually. The purpose of this study is to develop a methodical approach that can perform automatic eye localization and affine transformation of MWIR human faces. While MWIR images' facial features are occluded by human hair, we exploit the fact that it is noticeably darker than skin. This characteristic provides a steady local minimum that assists the horizontal line projections algorithm used to detect human eyebrows. Based on the eyebrow locations, the search space for the eyes becomes limited. Within this search space, the highest correlation coefficient with an average eye in the MWIR spectrum yields the eye coordinates. Experiments show that human eyes can be efficiently detected in the MWIR spectrum.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 9:

Correlation of optical parametric oscillators for progression of coherent anti-Stokes Raman scattering microscopy

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Nano-scale imaging of live tissue is desired for the progression of both research and medicine. The advancement of an imaging method known as coherent anti-Stokes Raman scattering (CARS) microscopy might provide a breakthrough. When certain chemical bond lengths interact with intensely focused beams of light, they become excited and resonate, producing identifiable signals. Signal intensity is greatly amplified when beams of light generated from two optical parametric oscillators (OPOs) are combined with a near-infrared beam from a Ti:Sapphire laser. The combined pulse is directed into a tissue sample where the resulting signals are collected and processed via raster scanning. The photons of three such beams were combined most efficiently by directing them with a series of dichroic mirrors and polarizing lenses. Greater voltages provide stronger signals and clearer images. A maximum photodiode voltage of 2.06 volts was identified by adjusting the micrometer of the final mirror to 4.895 cm and the angle of convergence of the final lens to 5.0°. This ensures the light is correlated to achieve second harmonic generation, making CARS microscopy possible.

Phys Sci & Eng Poster 10:

Communication Power Test for Wireless Sensor Network

Wentian Zhou, Brandon Rumberg, David Graham, Daryl Reynolds
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Sensor networking is a new field in Electrical Engineering. The network can be activated by specific signals which received by the sensor. Signals can be transferred in different ways, but the most desirable way is the most propagation with least power .The purpose of these experiments is to characterize the acoustic propagation for low power communications. The experiments can be separate into three parts: 1. the power consumed by microphone and speaker, 2 the power radiated by speaker, 3. the actual power received by the microphone based on distance between them. In order to get a flat frequency response after the amplifier of microphone, all devices require a flat frequency response for all frequency range. The maximum frequency of the speaker is 8.5KHz and the microphone goes up to 10KHz. the experiment is done by setting a fixed distance and changing the frequency of the speaker. ASPL (sound pressure level) meter is used to test the actual sound level and compare with the signal received by microphone. After the fixing distance experiment, choose a frequency which provide the best sound level, and then test at different distance to get the propagation result. The final result can be compared with other wireless communication method to determine the method with the most propagation and least power.

Physical Sciences and Engineering Category

Phys Sci & Enq Poster 11:

Determining whether Lorimer Burst-like radio pulses are atmospheric in origin

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In 2007, astronomers at West Virginia University discovered a radio pulse of extragalactic origin, afterwards called a Lorimer Burst. Subsequent investigations have yielded bursts sharing some characteristics of the Lorimer Burst, but appear to be atmospheric in origin. The events differ in two main ways: 1) the Lorimer Burst was a one-time event whereas the new pulses show yearly cycles centered on June and July and 2) the Lorimer Burst appeared to be localized while the new pulses were detected in multiple receiving beams. If the new pulses are indeed yearly atmospheric events, we should detect them in archival data. Programs have been written that filter through data from the Parkes Radio Telescope for pulses with the same dispersion characteristics as the atmospheric and Lorimer bursts and keep only the bursts detected in multiple beams. The pulses were then plotted by month to examine the yearly trends.

Phys Sci & Enq Poster 12:

A Novel Charged Bicyclic Aromatic Structures from 1,2,3-Triazole-Yne Cyclization and Its Application in Metal Coordiantion and New Materials Construction

Sharma S.; Chen, Y.; Wang, D.; Petersen, J. L.; Akhmedov, N.; Shi, X
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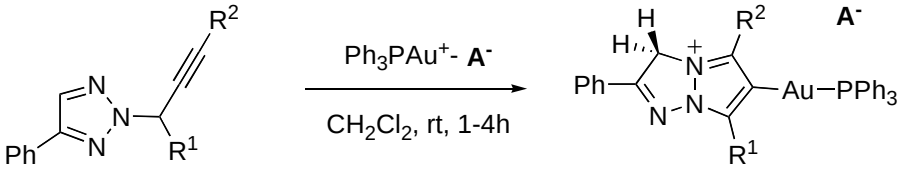
In the latest literature, several chemists have tried to synthesize organogold complexes; however, these complexes/catalysts were unstable in protic media with the Au-C bond being susceptible to hydration. Very recently, studies revealed that compound with Au-C bonds provided promising anti-cancer properties along with other interesting catalytic reactivity. It became more critical to provide effective strategy for the preparation of complexes with stable Au-C bond. Now, by utilizing triazole (subsequently triazole-alkynes) and the scheme of 5-Endo-Dig Cyclization, the first ever protic media-stable organogold catalysts were synthesized.



These newly developed complexes/catalysts are zwitterions; therefore, these catalysts, themselves, can be altered to synthesize a new compound that can be used as an ionic liquid. This certain ionic liquid could have certain vital characteristics such as: capability of coexisting with the previously mentioned organogold catalysts to remove carbon dioxide from the atmosphere by using the sunlight as fuel and increasing the efficiency of the lithium-ion battery are just a few of its many abilities. This pathway to the ionic liquid is the focus of current research.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 13:

Fabrication of Indium Gallium Nitride LEDs for use as Whispering Gallery Mode Sources and Sensors

Dominic Gutierrez, Vamsi Kumbham, Dimitris Korakakis, Larry Hornak
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Light emitting diodes (LEDs) are becoming increasingly necessary as efficient lighting and integrated optical sensing sources are required. A novel concept that has been proven theoretically is to use LEDs as Whispering gallery mode (WGM) generators and sensors. A WGM is achieved when a spectrum propagates around an optical cavity such that the circumference of the cavity is some whole number of wavelengths; Light of this specific wavelength is trapped internally while all others are radiated. This resonance condition can be altered, such as when a virus or bacterium attaches to the LED changing the circumference, and this change can be detected and the system used as a sensor. Our work focuses on the use of an electrically pumped LED as both the light source and WGM cavity. This requires much finer tolerances than are needed for traditional micro-LED fabrication. We present results from research efforts to 1) create a fabrication process that will be repeatable and have the tolerances necessary to support WGMs and 2) demonstrate that WGMs can be observed within electrically pumped LEDs.

Phys Sci & Eng Poster 14:

Development of a low pressure argon plasma sputtering method

D. Hudson Smith and Sergei Urazhdin
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Argon plasma sputtering is a simple and effective method for thin film deposition. However, sputtering requires a high argon gas pressure, which limits both the purity of the samples, and the deposition system geometries. The goal of this project is to achieve sputtering at lower pressures, by utilizing a resonant plasma excitation by AC/DC voltage, as well as by optimizing the deposition geometry to achieve stronger magnetic fields in the plasma region. To this end, we constructed a test high vacuum chamber and a high-voltage 1-MHz bandwidth AC/DC power source. We measured the effect of increased magnetic field in the plasma region, and the effect of varied driving frequency on the plasma properties. Initial tests suggest that driving near the cyclotron resonance of argon ions has a noticeable effect on the plasma current. By combining this effect with other improvements of the sputtering process, we expect to achieve the desired operation at lower gas pressures.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 15:

Microstructure Analysis of Yttria-Stabilized Zirconium based Solid Oxide Fuel Cells

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Department of Mechanical & Aerospace Engineering
West Virginia University, Morgantown, WV

With rising global environmental concerns, economic recession, and natural resource depletion, there is a significant need to develop new devices for the generation of energy that are cleaner, more efficient, and renewable. Solid Oxide Fuel Cells (SOFC's) are these novel energy systems. Yttria-stabilized zirconium (YSZ) based solid oxide fuel cells (SOFCs) are typically composed of a YSZ electrolyte, a (La,Sr)MnO_3 (LSM) and YSZ composite as the cathode and a porous composite of nickel-YSZ cermets as the anode. The project aims at enhancing SOFC performance, both by improving the understanding of degradation processes in commercial SOFC and simultaneously using that knowledge iteratively in developing improved materials resulting in enhanced performance. In the present study, the microstructure and chemistry of newly developed cathode materials, consisting of a nanocomposite of LSM and YSZ were evaluated using scanning electron microscopy (SEM) and transmission electron microscopy (TEM), and compared with those from commercial cells. These experiments reveal the advantages of nanocomposite cathode materials with larger area of grain boundaries and interfaces, which could increase the concentration of mobile defects and result in strong conductivity enhancement.

Phys Sci & Eng Poster 16:

Attachment of 1,2,3 triazole to magnetic silica-iron nanospheres

Alexandria L. Harris, Xu D. Yang*, Suzan Bilgesu , Dr. Dawei Wang, Dr. Lin Quan*, Dr. Xiaodong Shi
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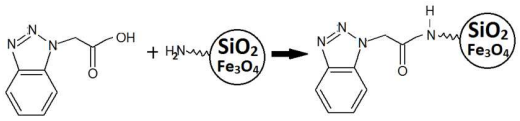
**College of Chemistry, Jilin University Qianjin Avenue 2699, Changchun, 130012, P. R. China*



Triazoles have been shown to have many uses. Due to biocompatibility, high stability, and relatively green production, triazoles are being used in many applications including drugs and sensors for heavy metal ions. Currently, packed gel columns are being used to separate the different products and starting materials. These columns are expensive due to the high material cost and time investment. The Dr. Shi research group and Dr. Quan research groups collaborated to attach triazoles to a Fe_3O_4 –SiO_2 nanosphere; the materials can be separated using magnets and simply pouring off the effluent.

An amine functional group was attached to the nanospheres. The reaction between the carboxyl and amine group would link the triazole to the polymer forming an amide group. In order to form the amide, benzotriazol-1-ylacetic acid, DMF, and DCC were combined and stirred. DMAP and Fe_3O_4 –SiO_2 nanospheres were added after two hours. Fourier Transform Infrared Spectroscopy (FTIR) was used to determine the composition of the product. The 1751.64 wavenummber (cm^{-1}) indicates the formation of the amide group. This suggests that the triazole is attached to the polymer.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 17:

Synthesis of gold/silicon dioxide core-shell nanoparticles

Jessica M. Lankford, Ming Li, and Nianqiang Wu
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Raman spectra are helpful at accurately determining the chemical composition of a given sample. The difficulties arise in getting consistent Raman spectra with noticeable intensities. In the present work, gold nanoparticle cores with Rhodamine dye attached to the surface are coated with a Silicon Dioxide (SiO_2) shell to amplify the Raman signal intensity. The process involved first making the gold nanoparticle (AuNP) cores by reducing chloroauric acid using trisodium citrate. This base was used for all coated samples. The coating process included three basic steps: mixing with Rhodamine, centrifuging to remove impurities, and reacting tetraethyl orthosilicate (TEOS) with ammonia to form the SiO_2 shell. A variety of samples with different Rhodamine amount and the shell thicknesses have been created. The shell thickness was varied by changing the TEOS amount added to the solution. By methodically varying the Rhodamine and TEOS amounts, we were able to determine the maximum amounts that would not cause the AuNPs to aggregate. For Rhodamine, the maximum amount was 60μL, and the maximum TEOS was 25μL.

Phys Sci & Eng Poster 18:

Synthesis and characterization of copolymers containing 1-(prop-2-en-1-yl)-1*H*-benzotriazole

Suzan A. Bilgesu, Chen Yang, Yang Xu Dong, Lin Quan, Xiaodong Shi*
State Key Laboratory of Supramolecular Structure and Materials, Jilin University, Changchun, Jilin, China

There have been many publications regarding polymers and copolymers of benzotriazoles some of which include ultraviolet radiation absorbers in plastics and other materials as well as coatings used to prevent the corrosion of steel. The purpose of this research is to polymerize 1-(prop-2-en-1-yl)-1*H*-benzotriazole. Several methods were used to achieve this including solution, bulk, and ultraviolet radiation polymerization. A copolymer with styrene was attempted to evaluate the radical quenching capability of 1-(prop-2-en-1-yl)-1*H*-benzotriazole. No polymerization was observed. Future research includes changing the reaction conditions of the polymerization as well as experiments using different benzotriazoles.

Physical Sciences and Engineering Category

Phys Sci & Enq Poster 19:

Production of Graphene Nano-Ribbons for Sensor Applications

Eugene E. Lewis, Charter D. Stinespring
Department of Chemical Engineering, West Virginia University

A major goal of our research is the development of graphene-based biosensors and biomimetic detectors. As part of this work, a reliable sensor platform is needed. One way of achieving this is to build devices on exfoliated graphene flakes or nanoribbons. In the research described here, we have adapted an approach described by Li et al.* to produce graphene flakes and / or nanoribbons. Intumescent graphite has been expanded under in a hydrogen atmosphere in a tube furnace and, as an alternative, by rapid heating in a microwave oven in air. The resulting material was them sonicated in 1,2-dichloroethane (DCE) or in a dilute mixture poly(mphenylenevinylene-co-2,5-dioctoxy-p-phenylenevinylene in DCE. The product was then centrifuged and particles from the supernatant deposited on a variety of substrates for analysis. The essential finding here is that the surfaces of these materials is not contaminated and can serve as the basis for subsequent device development.

*X. Li, X. Wang, L. Zhang, S. Lee, H. Dai, Chemically Derived, Ultrasmooth Graphene Nanoribbon Semiconductors, Science 319 (2008) 1229.

Phys Sci & Enq Poster 20:

Nano-enhanced, low-temperature solid-oxide fuel cells

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Energy Materials Program

Solid-oxide fuel cells (SOFCs) are promising power sources that have the capability of directly utilizing fuels such as hydrogen and various hydrocarbons to very high efficiencies. One of the critical technical barriers faced by commercialization of SOFCs is the required operating temperature >800°C, which results in degradation issues and places stringent durability requirements on the materials. This study aims to demonstrate an SOFC that is capable of functioning at <800C by utilizing a Bi2V1-xCuxO5.5-3x/2 (BICUVOX) electrolyte, which possesses an extremely high conductivity at relatively low temperatures. A gadolinium doped ceria (GDC) BICUVOX electrolyte will also be utilized because of its stronger mechanical strength compared to BICUVOX electrolyte. Regardless of its high ionic conductivity, researchers have not been able to demonstrate high power SOFCs utilizing the BICUVOX electrolyte due to limitations of chemical and reduction-oxidation (redox) instability. This work will address these issues through the use of novel nanomaterial electrodes and nano-phase ceria barrier layers. These materials can be processed and function at low temperature to abate the above-mentioned issues. The novel BICUVOX-supported SOFCs will be tested in a variety of fuels at temperatures <550C for times ranging between 2-48 hours.

Nanosciences Category

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Nanosciences Category

Nanosci Poster 1:

College students' perspectives and reasoning about nanotechnology risks and benefits

Brittany Witherspoon[1] and Eva Erdosne Toth[2]

1. *C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV*
2. *Department of Curriculum and Instruction/Literacy Studies, West Virginia University, Morgantown, WV.*

The introduction of novel technologies, such as nanotechnology, has become a topic of interest in scientific literacy and education. Consequently, the perspectives of the public on the risks and benefits associated with Nanotechnology are important. In this study, we collected and analyzed pre-service elementary teachers' perceptions on nanotechnology to further inform a larger scale instructional innovation for pre-service science teacher education. We surveyed students in an elective, media-literacy course through measurement instruments such as pretests, worksheets, and posttests to analyze their perspectives and reasoning as related to the use of nanotechnology for everyday problem solving. The results indicated that students had a "cautiously optimistic" perspective on the application of nanotechnology and that this general perspective was stable and unchanging after instructional innovation. However, we found interesting changes in how students reasoned for these opinions. The significance of the study is that it addresses the concerns of improving public literacy about novel technologies by way of elementary teacher training, and thus it establishes a way for public literacy that starts early in K-12 education.

Nanosci Poster 2:

Synthesis of a completely aromatic carbon nanotube end cap via construction of fullerene fragments

John P. Hunter, Bo Wen, Yangshen Sun, Kung Wang

C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV 26506

A carbon nanotube is organic compound in which the two ends of the nanotube mimics the structure of a sphere that has been cut in to two identical halves. The end cap of a carbon nanotube is the most essential in identifying its features and characteristics. In the field of organic synthesis, several carbon nanotubes have been synthesized and are being studied. However, our project involves the synthesis of a carbon nanotube end cap, which is completely aromatic, which has never been achieved in this field. It is hypothesized that this completely aromatic end cap could possibly exhibit many incredible characteristics such as extraordinary electrical conductivity and strength. Our synthesis begins with 1-indanone, which is reacted with various reagents made via Shinongashira coupling reactions; utilized to couple the hydrogen end of a triple bonded carbon with another R-group. Currently, we are still attempting to discover the best way to synthesize one of the starting materials. The yield for this step has been along the lines of 50%, which must be improved in order to be able to make more of the final product.

Nanosci Poster 3:

Nanotip arrays fabricated by colloidal microsphere lithography

Zachary C. Cohen, Shoujun Zhou, Dr. Bai Yang
State Key Laboratory of Supramolecular Structure and Materials, Jilin University, Changchun 130012 (P.R. China)

Biological systems, and the potential ability to mimic these systems, have provided the inspiration for technological advancements in numerous disciplines. The nanotip arrays that are often found upon the eyes of nocturnal insects (e.g. moths, dragonflies) are an excellent example of this, providing a plausibly copied optical surface. These surfaces are of particular interest due to several desirable properties – dramatically reduced reflection, increased light transmission, and the ability to support both cell adhesion and cell migration. In order to replicate these surfaces, SiO_2 nanospheres have been utilized to etch a silicon chip via colloidal microsphere lithography. This three step process includes preparing the chip via interface method, lithography, and etching via RIE (reactive ion etching). An acceptable method for replicating chips with nano-arrays containing differing sized posts within the array has been formulated. In addition, a relationship has been formed for etching time versus nanosphere spacing. Future work should involve perfecting the method for replicating nano-arrays containing differing sized posts.

Nanosci Poster 4:

Multi-walled carbon nanotubes as vehicles for enzyme encapsulation

J. Malone[1], A. Campbell[2], T. Sobray[2], C.Z. Dinu[2]
[1]*Chemistry Department, West Virginia University, Morgantown, WV 26506*
[2]*Department of Chemical Engineering, West Virginia University, Morgantown, WV 26506*

Carbon nanotubes are novel materials to be used for enzyme encapsulation. Beyond their direct advantages as smart material for protection and targeting of active ingredients, these new biohybrids will open up a wide range of novel potential applications such as optical storage, data encryption or security inks. In this study, the enzyme soybean peroxidase was physically absorbed onto multi-walled carbon nanotubes with different diameters (10-20 nm to 20-40 nm). The activity of the immobilized enzyme was tested and compared to the activity of the native (free) enzyme. Results showed that the loading and activity of immobilized enzyme is dependent on the nanotube used as support, specifically, lower loading was observed for tubes with less curvature. Next, we selectively removed the enzyme adsorbed by hydrophobic and electrostatic binding respectively. The resulting tubes supposedly contain encapsulated enzymes. We will use Raman spectroscopy to confirm this result.

Nanosci Poster 5:

Synthesizing protein nanotubes using GST

Sarah Robinson, Wei Zhang, and Junqui Liu
State Key Lab of Supramolecular Structure and Materials, Jilin University, Changchun, China

Protein nanotubes have been an area of interest in recent years because potential use in the medical industry. Specifically, certain variations of the nanotube display use in drug delivery. The goal of this project is to manipulate the protein GST to form a ring when exposed to nickel that can be used to create a nanotube. Two points were mutated on the surface of the protein to force the GST to assemble in the ring structure. Afterwards, nickel in different concentrations was added to samples of the protein determine if it would bind to the surface of the structure. Then, Atomic Force Microscopy and Scanning Electrons Microscopy were used to examine the samples for all possible nanostructures. The results from both of the tests reveal that the GST can assemble in two different structures, a nanoring and a nanoline. This confirms that GST can be used for synthesizing protein nanotubes once a better technique for creating the rings is developed.

Nanosci Poster 6:

Activity and stability studies for bionanoconjugates

A. Campbell, T. Sobray, C.Z. Dinu
Department of Chemical Engineering,West Virginia University, Morgantown, WV 26506

Enzymes have many advantages over their chemical counterparts in that they are more specific, and generally possess higher catalytic properties. Enzyme biotechnology has promising applications in food processing, brewery, paper and biofuel industries. However, the major problem associated with the practical application of enzymes is their limited storage and operational stability. Herein we are proposing to develop a universal platform for enzyme immobilization to lead to high enzyme loadings and activities, and increased stabilities. Our strategy involves physical or chemical binding of enzymes (i.e., soybean peroxidase, chloroperoxidase, etc.) to nanosupports with user-defined functionalities and surface properties (i.e., carbon nanotubes or TiO_2 nanobelts functionalized by surface treatments). We characterize the nanomaterial-enzyme conjugates in terms of loading (i.e., the amount of enzyme immobilized on the support), activity (i.e., the retained functionality of the enzyme), and stability and relate the data to the structural changes in enzyme at the interface with the nanosupport and the nanosupport surface properties (i.e., hydrophobicity, surface area, curvature etc.). Such strategies can be used to design hybrid and stable composite materials.

Nanosci Poster 7:

Optimization of luminance of organic light-emitting diodes containing *mer*-Alq_3

Nick Horvath, Chen Dong, Prof. Yue Wang, Prof. Hongyu Zhang
State Key Laboratory of Supramolecular Structure and Materials, Jilin University, Changchun, JL, P. R. China

This study aims to optimize the luminance of organic light-emitting diodes (OLEDs) by varying the ratio of thicknesses of the conducting and emitting layers. The OLEDs in this study consist of a conducting layer composed of N,N'-bis(1-naphthyl)N,N'-diphenyl-1,1'-biphenyl-4,4'-diamine, abbreviated NPB, and an emitting layer composed of *meridional*-tris(8-hydroxyquinolinato)aluminum, abbreviated *mer*-Alq_3, whose green electroluminescence characterizes the OLED. We constructed OLEDs whose conducting and emitting layers totaled 1000 Å by vacuum deposition and tested their luminances by performing electroluminescence at varying voltages. OLEDs with emitting layers of 200, 400, 500, 600, 650, 700 and 800 Å were constructed and tested, and the 600 Å OLED was found to be optimal with a maximum luminance of 7714 cd/m^2, reached at 9.4 V. We concluded that OLEDs with 60% emitting layer thickness have optimal luminance. The effect of multiple layers was also investigated; an OLED with two 200 Å conducting layers and two 300 Å emitting layers was found to have a maximum luminance of 7405 cd/m^2, reached at 16.0 V, suggesting a significantly higher plateau voltage for multi-layer OLEDs.

Nanosci Poster 8:

Polymer-based Photonic Crystal Biosensor

Caroline Kilemi, Anand Kadiyala, Bashar Hamza and Jeremy Dawson
Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV 26506

Photonic crystals (PhC) are microfabricated nano-structures with a varying dielectric permittivity in one, two, or three dimensions that possess unique light manipulation properties. They are the core structures in an ultra-sensitive biosensor that can be utilized to detect single biomolecules at very low concentrations, thus have a significant importance in health sciences, agricultural sciences, and counter-terrorism applications. A polymer-based photonic crystal was simulated using MIT Photonic-Bands (MPB), freely available software that computes optical band gaps of the structure. It was observed that a triangular lattice of holes in a polymer slab posses a partial band gap that can be tuned by varying the different lattice parameters such as: lattice constant, radius, height, length and width. Once the band gap was optimized, the lattice parameters were translated into a CAD file to fabricate a master mold in Silicon using Electron Beam Lithography. Simulation results as well as SEM images of the fabricated structures will be presented.

Nanosci Poster 9:

Calculation of the surface area of metal-organic frameworks

Makenzie E. Green, Bryant Doss, and James P. Lewis
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Metal-organic frameworks (MOFs) are a class of crystalline structures used in adsorption, separation, and detection applications. Because so many different MOFs exist, it is useful to characterize each structure to evaluate its utility in particular applications. One useful criterion for characterizing MOFs is the surface area of the pore. To calculate the surface area, the MOFs are modeled as fused hard-sphere structures; using this model, each atom in the framework is represented as a sphere with a radius equal to that of the atom. The surface area of the MOF is the total surface area of each sphere in the structure less the surface area that lies within any intersections of the spheres. A program was written in Python to identify intersections of two, three, or four spheres and to calculate, according to geometric expressions, the surface area lying within the intersections. Using this method, we hope to narrow down the number of candidate structures for uses ranging from sensing materials to photocatalysts.

Nanosci Poster 10:

Development of an LSF/YSZ Nanofiber Cathode for a Solid Oxide Fuel Cell

Nicholas Mariani, Mingjia Zhi, Nianqiang Wu
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Morgantown, WV

Yttria-stabilized Zirconia (YSZ) based solid oxide fuel cells (SOFCs) provide a reliable source of alternative energy but must be operated at temperatures above 800 °C. The high initial start up costs of a SOFC system can be dramatically reduced by developing a cathode that can be efficiently operated at lower temperatures. The YSZ nanofiber scaffolds developed by the electrospinning method have been infiltrated by a $La_{0.8}Sr_{0.2}FeO_3$ (LSF) precursor at a 1:1 weight ratio. The electrochemical impedance of the composite cathodes has been tested at 600 °C-800 °C and is considerably less than conventional commercial cathodes at all operating temperatures. The continual impedance reduction with increasing temperature proves that the YSZ/LSF construction method prevents LSF and YSZ reactions at the high testing temperatures, avoiding cathode degradation. The YSZ/LSF cathodes developed will facilitate the commercial use of SOFCs. The knowledge obtained will promote the development of renewable energy and the reduction of carbon dioxide emission.

Nanosci Poster 11:

The Effect of Electro-osmotic Flow on Diffusion Layer Growth

Kayla Sapp, William Booth, and Boyd Edwards
Department of Physics, West Virginia University, Morgantown, WV

We are concerned with diffusion layer growth at a charged nanopore under an electric potential applied to the membrane over time. The main phenomenon that is being studied is how electro-osmotic flow effects this diffusion layer growth in a one dimensional transient model. The theoretical model being used is taking into account this variable, by adding it into a continuity equation. The system is modeled to treat the nanopore as an area of additional charge density. This means that the nanopore is acting as a charge-selective membrane. To determine the effect a nonlinear partial differential solver is used to solve this continuity equation and Poisson's equation. This calculation will be compared to 2 dimensional models of a single nanopore.

Nanosci Poster 12:

1/f noise in Length and Type Sorted Single-Walled Carbon Nanotubes

Kristen M. Felice[1], Daneesh O. Simien[2], Clayton E. Simien[3]
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[3] *Research Assistant Professor Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV*

Carbon nanotubes were previously predicted to have low electrical noise characteristics, making them ideal materials for the development of next-generation nano-electronics; however, this is not the typical experimentally observed response. We therefore seek to contribute to the body of knowledge surrounding nanoscale devices by examining the role of nanotube structure in contributing to 1/f noise in nanoscale devices. We used our highly characterized, single-walled carbon nanotube (SWNT) thin film networks with lengths of 820nm, 210nm, and 130nm, and pure metallic and semiconducting SWNT networks to investigate configurational and structural contributions to increases in electrical noise potential in nanotube thin film devices. In this work we evaluate voltage noise power versus frequency, in the low frequency range, for each of our type sorted samples and investigate the effect of device scale and nanotube type, length, and dimensionality. We present the absorption spectra produced from our density gradient centrifugation processing techniques to render length-sorted SWNTs and metallic versus semi-metallic SWNTs. We also present our preliminary finding of noise power density in thin films made from our highly characterized SWNT materials.

Nanosci Poster 13:

Induction of nematic mesophase in surfactant-encapsulated, polyoxometalate-containing liquid crystals

Jessica A. Carr, Zhang Jing, and Lixin Wu
State Key Laboratory of Supramolecular Structure and Materials, Jilin University, Jilin, China

Ionic liquid crystals (ILCs) combine the properties of ionic liquids with the self organization of liquid crystals. In conjunction with polyoxometalates, their size, structure, and elemental composition can be greatly varied. They have potential applications in anisotropic ionic conductors, dye-sensitized solar cells, and nanomaterial synthesis. Most ILC research is limited to simple superstructures, smectic and columnar organizations. For application, it is desirable to obtain ILCs that have a less ordered mesophase, because they react to stimuli faster. This research intends to synthesize and characterize room-temperature, nematic phase, polyoxometalate-containing liquid crystals. A surfactant, A6, with laterally attached alkyl chains is used to induce the desired mesophase. Elemental analysis, NMR, and IR spectra are used to determine if the encapsulation is successful. DSC is used to study the complex's phase transitions in detail, and polarized optical microscopy and XRD are used to assign the mesophase. It was found that surfactant A6 can be used to encapsulate the polyoxometalate. The resulting complex exhibits liquid crystalline properties at room temperature and a nematic mesophase.

Nanosci Poster 14:

Methods for Investigating Quality of Multilayer Multiferroic Thin Films

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Computers store information as "ones" and "zeroes," which, in hard drives, correspond to an up or down magnetic domain direction. Changing this direction currently requires magnetic fields, which use a great deal of electricity, cause heating, and limit scaling possibilities. However, multiferroics are promising candidates for improving this field and others, such as energy scavenging and magnetic sensing. In some multiferroic materials, magnetic domains can instead be controlled through electric fields, so that many of these problems can be avoided. The Holcomb group searches for couplings between electric and magnetic orientations in different thin layers, and materials which couple most efficiently. It is important to measure how coupling is affected by factors such as surface and interface roughness and layer thicknesses. Of particular interest for measurement is a sample with varying thickness. This study aims to find which methods are best for verifying these parameters at precise locations along the sample. In this study, Atomic Force Microscopy was used to calculate surface roughness, while X-ray reflectivity data was fit in GenX to analyze layer thickness.

Nanosci Poster 15:

Electrochemical nanosensor based on enzymatic chain reactions

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Nanosensors based on enzymes are particularly attractive for various *in vivo* and *ex vivo* biomedical applications, including continuous *in vivo* monitoring of glucose in extremely small volumes, or biosensing in resistive organic media. Herein, we are developing a nanosensor based on co-immobilization of enzymes on carbon nanotube supports capable of measuring femtomolar concentrations of glucose or hydrogen peroxide in a cascade reaction. The high surface area of the nanotube template facilitates the preparation of nanotube-enzyme conjugates with high enzyme loadings per unit weight of the material. By using user-controlled nanotube surface properties and mixed strategies consisting of covalent and physical binding of enzymes onto the nanosupport, we are able to tailor the nanosensor characteristics (i.e., the concentration of the product). Such enzyme-based sensor principles can be further extended to offer a platform for nanosensor technologies and to allow investigations of more complex sensing schemes that will expand the range of analysts that can be detected and quantified.

Nanosci Poster 16:

Superparamagnetic iron oxide nanoparticles stabilized by pluronic copolymers in aqueous solution for drug-delivery

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Nanoparticles and nanotechnology present great opportunities to treat and diagnose human disease. Superparamagnetic Iron Oxide Nanoparticles[SPIONs] can be engineered to have molecular targeting capabilities and to act as transport agents for therapeutic drugs. Because of their magnetic nature, SPIONs can also act to pinpoint the location of drug delivery. It is hypothesized that anti-cancer drugs can be carried by SPIONs that have been modified with a surfactant coating. The goal of this research is to develop water-soluble SPIONs and assess their drug-carrying capacity. Uniform-sized oleic acid-coated SPIONs were synthesized by thermolytic decomposition. The SPIONs were subsequently modified by triblock copolymers (Pluronics, approved by the Food and Drugs Administration). These Pluronics form micelles in solution and can carry hydrophobic anticancer drugs. Four different Pluronic triblock copolymers, differing in size and relative hydrophobic/hydrophilic character, were attached to make the SPIONs water soluble. The successful synthesis of these particles was supported by FTIR, DLS, and TGA data. With this work, the foundation has been laid for future studies which will determine the relative efficiency of these nanoparticles as drug carriers.

Nanosci Poster 17:

Reactions of surfactants and polymer encapsulants on superparamagnetic iron oxide nanoparticles

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In recent years many research groups have studied SPIONs (superparamagnetic iron oxide nanoparticles) and their potential uses in areas such as RF-hyperthermic therapy for treatment of cancer and contrast enhancement in MRI imaging. During this research project, SPIONs were synthesized by thermal decomposition methods that result in an oleic acid-coated crystalline Fe_2O_3 product. SPIONs were characterized using FTIR and XRD. NMR analysis of the Oleic Acid surfactant on the SPIONs, after removal of the iron oxide core with EDTA, confirmed that Oleic Acid is not modified during the high temperature synthesis, as has been suggested by some published studies. Once characterized, SPIONs were encapsulated in PAA polymer and in altered forms of PAA polymer, both of which caused the once hydrophobic SPIONs to become hydrophilic. Reactions of alkyne-terminated copolymer with 11-azido-3,6,9,trioxaundecan-1-amine and subsequently with fluorescein isothiocyanate dye were used to study the kinetics of reactions at the SPION surface by NMR, IR, absorbance/emission spectroscopy. Ligand exchange reactions were carried out, during which dopamine replaced oleic acid on the SPIONs making them water soluble.

Nanosci Poster 18:

Absorption of cytochrome P450 2C9 to a variety of self-assembled monolayers

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Cytochrome P450 metabilizes ~75% of all drugs and we are interested in factors that may alter metabolism such as aggregation of P450, which occurs *in vitro* but not *in vivo*. Here, we characterize the adsorption of the P450 CYP2C9 to self-assembled monolayers (SAM) that will be used in a nanostructure device in which P450 is monomeric. Protein-surface interactions were studied by X-ray photoelectron spectroscopy and showed peaks due to silver/SAM prior to treatment with P450 and to P450 (nitrogen) following exposure. Surface plasmon resonance showed P450 binds to nonpolar SAMs (octane thiol, OT); poorly to polar SAMs bearing ethylene glycol ends (EG6), and can be removed with detergents. Thus, if islands of OT can be made of the size of CYP2C9 and that are surrounded by EG6, we will be able to build a nanostructured device with P450 in the monomeric form and use it to make better *in vitro* to *in vivo* drug metabolism predictions. (Support: REU fellowship to A.W. (NSF DMR-1004431), WVU Research Corp, and the WVU Eberly College of Arts and Science.)

Nanosci Poster 19:

Sustained methotrexate delivery due to PLGA barrier layers in thin films

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Two issues in fighting cancer are getting medicine to the tumor without attacking healthy cells and how to get drugs to the cancer over a long period of time. The goal of this study is to fabricate a thin film capable of freestanding and sustained methotrexate release. Thin films were fabricated with a removable sacrificial layer to achieve freestanding status. This sacrificial layer was followed by a supporting layer of PLGA and functional layer of layer by layer assembled PAH-D and Hyaluronic Acid loaded with methotrexate. Varying thicknesses of PLGA were used to test the effectiveness of a final barrier layer in slowing the release rate of the drug. The films were put in a .2M PBS solution at 37 degrees Celsius to mimic the human body for the experiment, with UV-vis spectra taken at specified times. It is found that a barrier layers made with concentrations of 5mg/ml and 10mg/ml can slow the peak release by 24 hours, while a 20mg/ml barrier layer can sustain the release for over 13 days.

Nanosci Poster 20:

STEM based education outreach to northern West Virginia institutions and 4-H camps

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Research shows that interest in the STEM (Science, Technology, Engineering, and Math) fields, particularly among middle school and high school students, is not as high as competing study areas. The purpose of the 4-H outreach and other presentations and demonstrations is to increase interest and desire for learning in the STEM fields among young students. Involvements of the outreach program include a summer science camp offered at West Virginia University, presentations given at county 4-H camps, and a 2-week stay at the state 4-H camp at the West Virginia University Jackson's Mill facility. Hands on stations demonstrate polymerization, refractive index, pH, density, displacement reactions, reduction-oxidation reactions and nanotechnology to the students. Information gathered from surveys given to all students has shown a 27% increased interest in science reported by the students from prior to the presentation to after the demonstration. This was found to be statistically significant by a t-test with alpha level 0.001. This illustrates the effectiveness, and need for increase, of science outreach to students of these ages.

Nanosci Poster 21:

CdSe/ZnS quantum dots with molecular metal chalcogenide surface ligands placed in monolayers using micro-contact.

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The efficiency and quality of video displays has consistently been improved upon since conception. One strong candidate for the future of displays is the Quantum Dot, because of its very pure emission bandwidth. Our research focuses on combining two different techniques to raise the efficiency of Quantum Dots to the level of OLED. The first is a replacement of the hydrocarbon surface ligands with molecular metal chalcogenide surface ligands in a hydrazine process. The second technique uses a micro-contact method of placing Quantum Dots within an LED layer. The replacement of the surface ligands will force the micro-contact method to be adapted to the new polar soluble Quantum Dots. The CdSe/ZnS core shell nanoparticles will be analyzed for photoluminescence, absorption, and analyzed for contents by FTIR. After they are placed in LEDs, they will be analyzed for electroluminescence and photoluminescence. Current studies have attributed both of the preceding techniques separately to improved performance. The combination of the two techniques should cause performance that drives Quantum Dot LED research.