2009

2009 Symposium Brochure

WVNANO SURE/REU, WVU HONORS SURE, BIOLOGY REU

SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM 2009

THURSDAY, JULY 30, 2009
MOUNTAINLAIR BALLROOMS
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 2009
West Virginia University

Thursday July 30, 2009
Moutainlair Ballrooms

I. Schedule of Events

10:30 AM	*All undergraduate participants: arrive, register, and put up posters*
10:50 AM	*Introduction by David Lederman*
10:53AM	*Welcome by Dean Garbutt*
11:00-11:30 AM	*Open informal judging of poster boards (no presentations)*
11:30 AM-11:50 AM	*Remarks by President Clements*
11:55 AM	*Luncheon (judges and poster presenters first priority)*
12:30-3:00 PM	*Poster session with concurrent judging of presentations*
	Judges have preference!
3:00-3:30 PM	*Judges confer and determine top poster/presenter in each category*
3:30 PM	*Awards ceremony*
4:00 PM	*Post-questionnaires (WVNano REU/SURE participants) in 112 Clark Hall*

II. Poster Judges

Judge	**Category Judging**
Sergei Urazhdin, Physics	*Biological Sciences*
Bojan Cukic, Comp. Sci. & EE	*Biological Sciences*
Harry Finklea, Chemistry	*Agricultural & Environmental Sci.*
Justin Legleiter, Chemistry	*Agricultural & Environmental Sci.*
Pat Callery, Pharmaceutical Sci.	*Physical Sciences and Engineering*
Jeffrey Wells, Biology	*Physical Sciences and Engineering*
Max Houck, Forensics	*Nanosciences*
Tim Phipps, Agric. Res. Economics	*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. David Lederman, co-PI: Dr. Michelle Richards-Babb)

Participant	Major	Home School	Faculty Advisor
James R. Arndt, III	Chemistry	Shepherd U.	Dr. Nick Wu, Mech. & Aerosp. Eng.
Frank M. Davis	Physics	Grove City College	Dr. David Lederman, Physics
RaQuetta M. Howard	Physics	Alabama A&M	Dr. Peter Gannett, Pharmacy
Jason Jackson	Eng./Physics	WV Wesleyan College	Dr. Jeremy Dawson, Elect. Eng.
Zachary A. Jones	Chemistry	Campbell U.	Dr. Lloyd Carroll, Chemistry
Matthew S. Simmons	EE & CE	Western Carolina U.	Dr. Jeremy Dawson, Elect. Eng.
Briana Wallace	Chem. Eng.	Carnegie Mellon U.	Dr. Letha Sooter, Biology
Rachel Wallner	Chem. Eng.	NJ Inst. of Technology	Dr. Lloyd Carroll, Chemistry
Jana Woofter	Chemistry	Fairmont State U.	Dr. Lisa Holland, Chemistry
Amanda Wriston	Chemistry	WV Wesleyan College	Dr. Letha Sooter, Biology

B. Center for Identification Technology Research (CITeR) Research Experiences for Undergraduates (REU) Supplement (PI: Dr. Larry Hornak)

Participant	Major	Home School	Faculty Advisor
Jason M. Grant	Comp. Eng.	U. of MD Baltimore Co.	Dr. Larry Hornak, Elect. Eng.
Nnamdi Osia	Comp. Eng.	U. of MD Baltimore Co.	Dr. Thirimachos Bourlai, Eng.

C. 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
Natalie A. Allen	Psychology	Virginia Tech U.	Dr. Dan Panaccione, Plant & Soil Sci.
Tabitha Amendolara	Env. Sci	Goucher College	Dr. Alan Sexstone, Plant & Soil Sci.
Tyler Bedick	Biology	West Virginia U.	Dr. Carina Barth, Biology
Philip Curtis	Geography &	Syracuse U.	Dr. Brenden Meneil, Geography
Ariel Diliberto	Env. Studies	Vassar College	Dr. Yong-Lak Park, Entomology
Benjamin Laubender	Env. Sci/Bio	Heidelberg U.	Dr. Jennifer Steuckle, Biology
Kristen Magnuson	Biology w/ Env. Stud. Conc.	Bryn Mawr College	Dr. Kathryn Piatek, Forestry
Brittany M. Ott	Biolog. Sci	Virginia Tech U.	Dr. Rita V.M. Rio, Biology
Charles Parsons	Biology	U. of Richmond	Dr. Richard Thomas, Biology
Daniel T. Paul	Env. Sci & Biology	Allegheny College	Dr. Jonathan Cumming, Biology
Amy E. Rowlatt	Biology & Env. Stud.	Warren Wilson C.	Dr. Stephen DiFazio, Biology
Eric Winter	Env. Sci.	Allegheny College	Dr. William Peterjohn, Biology

D. WVNano Summer Undergraduate Research Experiences (SURE) Site (Dr. MichelleRichards-Babb, Coordinator, and Dr. David Lederman, WVNano Interim Director)

Participant	Major	Home School	Faculty Advisor
Brooke Adams	Physics	West Virginia U.	Dr. James Lewis, Physics
Masih Ahmed	Biology	West Virginia U.	Dr. Michael Shi, Chemistry
Austin Anuta-Darling	Physics/Math	West Virginia U.	Dr. Boyd Edwards, Physics

Participant	Major	Home School	Faculty Advisor
Saba Ashfaq	Ex. Phys/ Nanotech Emph.	West Virginia U.	Dr. Letha Sooter, Biology
Amber Bartlett	Aerosp. Eng.	West Virginia U.	Dr. Nick Wu, Mech. & Aerosp. Eng.
Suzan Bilgesu	Biology	West Virginia U.	Dr. Michael Shi, Chemistry
Sarah Caprio	Chem. Eng.	West Virginia U.	Dr. Dimitris Korakakis, Elec. Eng.
Jared Crawford	EE & CE/ Nanotech Emph.	West Virginia U.	Dr. Jeremy Dawson, Elec. Eng.
Scott Cushing	Physics	West Virginia U.	Dr. Nick Wu, Mech. & Aerosp. Eng.
Vincent DeGeorge	Physics	John Carroll U.	Dr. Sergei Urazhdin, Physics
Samuel Ducatman	Physics/ Math	Grinnell College	Dr. David Lederman, Physics
James Eakins	Physics/ Nanotech Emph.	West Virginia U.	Dr. Boyd Edwards, Physics
Brandi Findley	Biology	West Virginia U.	Dr. Letha Sooter, Biology
Makenzie Green	Mathematics	West Virginia U.	Dr. Lisa Holland, Chemistry
Tarra Hall	Chemistry	Marshall University	Dr. Lisa Holland, Chemistry
Jordan Helmick	Biochemistry	West Virginia U.	Dr. Nyles Charon, Microbiology
Andrew Higgins	Physics/Math	West Virginia U.	Dr. Sergei Urazhdin, Physics
Jason Kang	Chemistry	West Virginia U.	Dr. Nick Wu, Mech. & Aerosp. Eng.
Stephanie Knittle	Biology	West Virginia U.	Dr. B. Li, Orthopedics
Allison Krumanacker	Aerosp. Eng.	West Virginia U.	Dr. Andrew Cao, Comp. & Elect. Eng.
Molly Nagowski	Chem. Eng.	West Virginia U.	Dr. Charter Stinespring, Chem. Eng.
Charles Ndhlovu	Mining Eng.	West Virginia U.	Dr. Ed Sabolsky, Mech. & Aerosp. Eng.
Denzel Parks	EE & CE/ Nanotech Emph.	West Virginia U.	Dr. Parviz Famouri, Comp.&Elect. Eng.
Matthew Payne	Chem. Eng.	West Virginia U.	Dr. Lloyd Carroll, Chemistry
Maranda Poling	Chem. Eng.	West Virginia U.	Dr. Michael Shi, Chemistry
Aaron Routzahn	Chemistry	West Virginia U.	Dr. Lloyd Carroll, Chemistry
Adam Sadowski	Biology/ Chemistry	West Virginia U.	Dr. Lloyd Carroll, Chemistry
Jonathan Thornton	Mech. & Aerosp. Eng.	West Virginia U.	Dr. Dimitris Korakakis, Elec. Eng.

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

Participant	Major	Home School	Faculty Advisor
Neil Bowman	Comp. Eng.	West Virginia U.	Dr. David Lederman, Physics
Jacob Fennick	Physics/ Comp. Sci.	West Virginia U.	Dr. James Lewis, Physics
Josh Fernandez	Chem. Eng.	West Virginia U.	Dr. Boyd Edwards, Physics
Alexandria Harris	Chem. Eng.	West Virginia U.	Dr. Michael Shi, Chemistry
Gregory McKelvey	Biology	West Virginia U.	Dr. Peter Gannett, Pharmacy
Darius Reynolds	Engineering	West Virginia U.	Dr. James Lewis, Physics
Larry Rush	Chemistry	West Virginia U.	Dr. James Lewis, Physics
Lori Rush	Chemistry/ Ind. Math & Stat.	West Virginia U.	Dr. James Lewis, Physics

F. WVU Honors Summer Undergraduate Research Experiences (SURE) Site (PI: Dr. Keith Garbutt and Marie Leichliter, SURE Coordinator)

Participant	Major	Home School	Faculty Advisor
Elizabeth Banta	Psychology & Biology	West Virginia U.	Dr. Kennon A. Lattal, Psychology
John Barnard	Biochemistry	West Virginia U.	Dr. Kenneth Blemings, Animal Science
Cynthia Bollinger	Chemistry	West Virginia U.	Dr. Kung Wang, Chemistry
Elizabeth Bolte	Biochemistry	West Virginia U.	Mariam Lekveishvili, Biology
Noemi Borsay	Mathematics	West Virginia U.	Drs. Gerald Hobbs & James Denvir, Statistics
Kathryne L. Bucks	Animal & Nutritional Sci.	West Virginia U.	Dr. Joseph Moritz III, Animal Science
Elizabeth Cordonier	Biochemistry	West Virginia U.	Dr. Janet Tou, Animal Science
Zain F. Jafri	Computer Sci & Biometrics	West Virginia U.	Dr. Larry Hornak, Elect. Eng.
Kayla K. Kanosky	Biochemistry	West Virginia U.	Dr. Kim Barnes, Animal Science
Matthew Malone	Forest Res.	West Virginia U.	Dr. William McDonald,Plant & Soil Sci.
Brittany McCutcheon	Animal & Nutritional Sci	West Virginia U.	Dr. Joe S. Moritz, Animal Sci.
Stephen Naymick	Chemistry	West Virginia U.	Dr. William McDonald,Plant & Soil Sci.
Jessica A. Paolucci	Biology	West Virginia U.	Dr. Karen Weiler, Biology
Phillip M. Pifer	Chemistry	West Virginia U.	Dr. Justin Legleiter, Chemistry
Sawan V. Prabhu	Biology	West Virginia U.	Dr. James Belanger, Biology
Ben Sade	Biology	Shepherd U.	Dr. Alan Sexstone, Plant & Soil Sci.
Zachery Santer	Mechanical & Aeorosp. Eng.	West Virginia U.	Dr. Ed Sabolsky, Mech. & Aerosp. Eng.
Eric J. Seachrist	Biology	West Virginia U.	Dr. James Belanger, Biology
Abigail G. Shelton	Biology	West Virginia U.	Dr. Kim Barnes, Animal Science
Marci Smeltz	Chemistry & Forensic Chem.	West Virginia U.	Dr. Suzanne Bell, Chemistry
Alfred Stump	Chemistry	West Virginia U.	Dr. Bjorn Soderberg, Chemistry
Ian Townsend	Chemistry	West Virginia U.	Dr. George O'Doherty, Chemistry
Ravi Viradia	Biology	West Virginia U.	Dr. Jeffrey Wells, Biology
Adrya Webb	Wildlife & Fisheries	West Virginia U.	Dr. Yong-Lak Park, Entomology
Ashley Whetsell	Biochemistry	West Virginia U.	Dr. Jed Doelling, Plant & Soil Sci

G. WVNano SURE/4-H Camp Outreach (Michelle Richards-Babb, Coordinator, Eric Kincaid, Nano Curriculum Development, Chad Higgins, 4-H Extension Curriculum Specialist, Roger Hanshaw, Assoc. Direct. Extension)

Participant	Major	Home School	Faculty Advisor
Kara George	Pharmacy	West Virginia U.	Dr. Michelle Richards-Babb, Chemistry
Toni Zito	Sec. Sci. Teach.	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 SURE	Scientific Ethics
		Honors/WVNano SURE	Effective Presentations
Michelle Richards-Babb	Dept. of Chemistry WVU	WVNano REU	Oral Present. Skills/Lab Notebooks
		WVNano SURE	Scientific Ethics
		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
Roger Wright	Env. Health & Safety WVU	WVNano REU	Fire Safety Training
Clint Springer	Academician: Asst. Prof. Saint Joseph's University	Biology REU & Honors/WVNano SURE	Career Mentoring & Research
Lisa DeFrank-Cole	Honors College WVU	Honors/WVNano SURE	ASPIRE program & Scholarships
Jeffrey Wallace	Industry: Lead Scientist Mylan Pharmaceuticals	WVNano REU & Honors/WVNano SURE	Career Mentoring & Generic Pharm. Industry
Katie Stores	Grants Management Spec. WVU	Honors/WVNano SURE	Grant Writing Workshop
Brad Herrick	Government Lab Env. Prot. Agency (EPA)	Biology/WVNano REU & Honors/WVNano SURE	Career Mentoring & Government Lab work
Vic Johnson	Government Lab NIOSH	Biology/WVNano REU & Honors/WVNano SURE	Career Mentoring & Government Lab 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
CITeR: www.citer.wvu.edu
Biology REU: http://reu.as.wvu.edu
WVUHonors 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
David Lederman, PI
Michelle Richards-Babb, co-PI
Christie Zachary, WVNano Public Relations
Kara George, Guide

CITeR REU Supplement
Larry Hornak, PI

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

WVNano SURE
Michelle Richards-Babb, Educ. Coord.
David Lederman, WVNano Interim Direct.
Christie Zachary, WVNano Public Relations
David Miller, LSAMP Coordinator at WVU

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

WVUHonors SURE
Keith Garbutt, PI
Marie Leichliter, SURE Coordinator
Chelsea Richmond, SURE Intern
Shadron Starnes, SURE Intern
Cody Ford, SURE Intern

WVNano SURE/4-H Camp
Michelle Richards-Babb, Coordinator
Chad Higgins, 4-H Curriculum Specialist
Roger Hanshaw, Assoc. Direct. Ext.
David Lederman, WVNano Interim Dir.
Eric Kincaid, Nanoscience Curriculum Developer
Toni Zito, Curriculum Delivery
Kara George, Curriculum Delivery

Symposium Booklet
Michelle Richards-Babb
Stephen Tyler McGraw
Christie Zachary

Symposium Planning

Chelsea Richmond	Christie Zachary
Shadron Starnes	Michelle Richards-Babb
Cody Ford	Keith Garbutt
Meghan Powers	

B. Financial Support

1. **WVNano REU (PI: David Lederman, co-PI: Michelle Richards-Babb)**
   National Science Foundation (NSF) Division of Materials Research (DMR-0647763) and in part by WVNano (recreational activities) and the WVU Eberly College of Arts and Sciences.

2. **CITeR REU Supplement (PI: Lawrence A. Hornak)**
   Sponsored in part by the NSF Industry/University Cooperative Research Centers (I/UCRC) Program through a Research Experiences for Undergraduates (REU) Supplement to grant IIP-0641331 made to the Center for Identification Technology Research (CITeR).

3. **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.

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

5. **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 and the WVU Eberly College of Arts and Sciences.

6. **WVUHonors 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**
   Partially funded by WVNano, WVU Extension, and 4-H.

8. **Research Symposium Monetary Prizes**
   WVU Research Office (special thanks to Curt Peterson, Vice President of Research)

Biological Sciences Category

Bio Sci Index

Biological Sciences Category

Poster 16: *A Novel Synthesis of 3-Hydroxycarbazoles.* A.B. Stump and Bjorn Soderberg

Poster 17: *Carboxylesterase (hCE1) as a Possible Bioscavenger Against Organophosphorus (OP) Nerve Agents.* Brooke E. Adams[2], James P. Lewis[2], Robyn Ayscue[1] and Peter M. Gannett

Poster 18: *Physiological response of medaka (Oryzias latipes) to South Branch Potomac River sediment extracts.* Ben Laubender[1], Jana Woofter[2], Lisa Holland[2], and Jennifer Ripley-Stueckle[1]

Biological Sciences Category

Bio Sci Poster 1:

ROLE OF *ARABIDOPSIS THALIANA* UBP12 AND UBP13 IN THE GIBBERELLIC ACID SIGNALING PATHWAY

Ashley Whetsell and Jed Doelling
West Virginia University

The ubiquitin pathway is critical for the proper development of all eukaryotic organisms and is involved in many hormone signaling pathways. The ubiquitin pathway is responsible for the covalent attachment of the polypeptide ubiquitin onto selective proteins, thereby tagging them for degradation. The cellular pool of ubiquitins are generated and maintained by ubiquitin-specific proteases (UBPs). Human USP7 can remove ubiquitins from specific target proteins, thereby delaying their degradation. Since Arabidopsis UBP12 and UBP13 are orthologs of human USP7, they may also function in target-specific deubiquitination. Double mutant *Arabidopsis thaliana* lacking functional *UBP12* and *UBP13* demonstrated delayed seed germination, reduced stem elongation, and infertility. Since Arabidopsis plants with impaired gibberellic acid signaling displayed similar aberrant phenotypes, we reasoned that UBP12/13 might contribute to gibberellic acid signaling. UBP12/13 might indirectly destabilize RGL2, a regulator of gibberellic acid responses. Therefore, the transcript levels of several known gibberellic acid-induced genes were compared between wild-type and *UBP12/13* double homozygous mutant plants. Also, the germination dates of *UBP12/13* double homozygous mutants were analyzed both in the presence and absence of RGL2.

Bio Sci Poster 2:

Investigation into the Reductive Metabolism of TNT by Cytochrome p450 Enzymes

Marci Smeltz*, Melissa Gayton-Ely, Lucy Oldfield, Diaa Shakleya, and Suzanne C. Bell
C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV

When a foreign compound enters the human body, the process of metabolism occurs (phase I and II). Many aspects of metabolism are still under investigation, especially those related to reduction reactions' conditions and enzyme activity. Studies have been conducted on 2,4,6-trinitrotoluene (TNT), yet questions still abound. As an aromatic nitro compound, TNT undergoes nitro reduction, a process requiring anaerobic conditions and NADPH. This study will provide information on the metabolic products of TNT and their associated production through reductive reactions and quantitative measurements with standards, Flunitrazepam (Rohypnol®) and dichloronitrobenzene. Human metabolism of these three chemical compounds have been investigated, but never tied together for analysis. An in-vitro metabolism using human liver microsomes, enriched with cytochrome p450 enzymes, and NADPH was conducted on these compounds. A major aim of this investigation was to examine the solubility properties of TNT and each standard in a variety of solvents, including methanol, dimethylformamide, and potassium phosphate monobasic. Further investigation will be allotted to understanding the conditions, reactions, and metabolic products associated in phase two metabolism via human liver microsomes.

Biological Sciences Category

Bio Sci Poster 3:

COMPARATIVE ANAYSIS OF LEG COORDINATION OF CENTIPEDES

Eric J Seachrist and Dr. Jim Belanger
Department of Biology, West Virginia University

Forward walking is a highly complex movement that is cooperatively controlled by central oscillators of the central nervous system and sensory feedback of the peripheral nervous system. Leg coordination is thought to be governed by two major rules: a leg cannot start a return stroke until load is transferred to an ipsilateral neighbor, and contralateral legs operate in antiphase. Leg amputation can affect the coordination of movement and reveal how these rules are implemented by the nervous system. Centipedes of three orders, scutigeromorpha, scolopendromorpha, and lithobiomorpha, were filmed with high speed camcorders. Comparative observations show differences in anatomy and gait. Scolopendromorphs move their legs in a metachronal wave that begins at the anterior. Further motion analysis will compare adaptations to leg coordination after systemic amputation of single and multiple legs at different regions of the body. This study will determine and compare locomotion coordination and control in centipedes. Furthermore, this study may discover implications toward the evolution of centipedes and other myriapods.

Bio Sci Poster 4:

The Effects of Feeding Omega-3 Rich Oils on Tissue Deposition in Female Rats

E. Cordonier*, S. Altman, and J. Tou
Division of Animal and Nutritional Sciences, West Virginia University, PO Box 6108, Morgantown, WV 26506

Krill is a marine crustacean that provides a potentially rich source of the omega-3 fatty acids, eicosapentaenoic acid (EPA, 20:5 ω-3) and docosahexaenoic acid (DHA, 22:6 ω-3). The study objective was to determine tissue deposition of fatty acids in rats fed krill oil. Young(28d) female Sprague-Dawley rats(n=10/group) were fed diets consisting of either 12% krill oil or corn oil which is low in ω-3 fatty acids. At the end of the 8 week study, the fat pads and liver were dissected and tissue fatty acid composition determined by lipid extraction followed by transmethylation. The methylated samples were then analyzed by gas chromatography. Rats fed krill oil had higher $P<0.001$ EPA ($1.9\pm0.3\%$) and DHA ($2.0\pm0.2\%$) in the fat pads than those fed corn oil. In the liver, rats fed krill oil had higher $P=0.008$ EPA ($8.6\pm0.3\%$) and DHA ($19.8\pm0.4\%$) compared to EPA ($0.7\pm0.03\%$) and DHA ($3.7\pm0.2\%$) levels in rats fed corn oil. Therefore krill oil provides a rich source of health benefitting ω-3 fatty acids.

Biological Sciences Category

Bio Sci Poster 5:

Effect of dietary conjugated linoleic acid (CLA) on muscle lipid content in mice

K. M. Kanosky* and K. M. Barnes
Division of Animal and Nutritional Sciences, West Virginia University, Morgantown, WV, 26506

CLA is a group of fatty acids that reduce body fat loss in many species. Pigs fed CLA have decreased backfat, and increased marbling, thus improving pork quality. Previously we observed pellet-fed mice consumed less feed then powder-fed mice. The objectives were to determine the effect of dietary CLA in powdered and pelleted diets on body fat and muscle lipid. Forty male mice (56-d-old) were fed 7% soy oil powdered or pelleted diets for 14 days. Mice were blocked by body weight (BW) and received either 0 or 0.5% CLA for an additional 14 days. Feed intake (FI) and BW were measured twice per week. Fat pads and muscles were removed and weighed. A body fat index was calculated and muscle lipid was measured. CLA caused no differences in FI or BW, but powder-fed mice ate less ($P<0.001$) than pellet-fed mice. CLA reduced ($P<0.05$) the body fat index, regardless of diet form, and reduced ($P<0.05$) the muscle lipid. Unlike CLA-fed pigs, CLA-fed mice may not accumulate lipid in their skeletal muscle.

Bio Sci Poster 6:

Investigation of the PEV modifier and lethal phenotypes of E(var)3-5 mutants

Jessica A. Paolucci and Karen S. Weiler
Life Science Building, West Virginia University, Morgantown WV 26506
301-707-9598
jpaolucc@mix.wvu.edu

Position effect variegation (PEV) occurs when genes are relocated from areas of heterochromatin to areas of euchromatin or vice versa (Schultz, 1936). We have investigated a mutation, *E(var)3-5*, that dominantly alters the expression of variegating genes. One mutation discovered on the *E(var)3-5* chromosome destroys the function of the *CG17360* gene, resulting in recessive lethality. To better define the relationship between *E(var)3-5* and *CG17360*, three related projects were initiated. It was found that a *CG17360* transgene rescued the recessive mutant phenotype of *CG17360* which allowed us to test the ability of the transgenic *CG17360* to rescue the dominant affects of *E(var)3-5* on PEV. If successful, this would confirm that the mutation in *CG17360* on the *E(var)3-5* chromosome donates to the *E(var)* phenotype. Additionally, the *E(var)* phenotype was mapped using deficiencies and P element mediated male recombination. Southern analysis was used to determine the nature of the DNA lesion in *CG17360*. Outcomes from this research will lead to understanding the molecular basis for differences in chromosome structure and the role of chromosome structure in gene expression.

Schultz, J. 1936. Variegation in Drosophila and the inert chromosome regions. Proc. Natl. Acad. Sci. U.S.A.

Biological Sciences Category

Bio Sci Poster 7:

FEED INTAKE AND TISSUE FATTY ACID PROFILE OF CONJUGATED LINOLEIC ACID (CLA)-FED MICE

A.G. Shelton*, V.J. Shelton, and K.M. Barnes
Division of Animal and Nutritional Sciences, West Virginia University, Morgantown, WV, 26506

CLA is a group of fatty acids that are a potential treatment for obesity. Our objectives were to determine the effect of dietary CLA on feed intake, body fat, and tissue CLA concentration. Male mice (n=150; 9-wk-old) were fed a 7% soy oil (SO) diet for 7 days, then allotted to receive 0 (ad libitum or pair-fed to the intake of CLA-fed mice) or 2% CLA for 1, 2, 3, 5, or 7 days. Mice were then killed, tissues were collected and weighed, and a body fat index was calculated. Tissue lipids are being analyzed for their fatty acid profiles. CLA-fed mice, and therefore pair-fed SO-fed mice, ate less ($p<0.05$) than ad libitum SO-fed mice on days 1, 2, 3, and 7. Mice did not differ in body fat until day 7 ($p<0.01$) when CLA-fed mice were leaner than both SO-fed groups. In conclusion, dietary CLA caused a decrease in feed intake; however, that decrease was not sufficient to cause a decrease in body fat, indicating that CLA has additional anti-obesity actions.

Bio Sci Poster 8:

PURIFICATION OF THE HOOK PROTEIN IN THE LYME DISEASE CAUSING BACTERIA BORRELIA BURDORFERI

Jordan L. Helmick, Kelly A. Miller, and Nyles W. Charon
West Virginia University, Department of Microbiology, Immunology, and Cell Biology, Health Sciences Center, Morgantown, WV, 26506

Borrelia burgdorferi is a species of spirochetes, which is a class of bacteria well known for its unique motility and infectivity. The hook protein, FlgE, is the structural protein that connects the periplasmic flagellar filament to the basal body of the internal cell cylinder. Several lines of evidence suggest that FlgE in *B. burgdorferi* is unique, as it exists as a multimeric, cross-linked structure. This cross-linking is hypothesized to provide flexibility and mechanical strength. Understanding the structure of this protein is fundamentally important in understanding the motility of spirochetes.

To identify the chemical bonds which form cross-links, we are comparing protein digests of monomeric recombinant FlgE (rFlgE) to that of the native protein (FlgE). As a first step, nickel affinity and guanidine HCl treatments were used to purify rFlgE obtained from *Escherichia coli* cells transfected with *B. burgdorferi flgE*. Treatment of guanidine HCl on the insoluble cell lysate resulted in markedly increased rFlgE purity. Following purification, peptide analysis of rFlgE and native FlgE will then be used to unlock the means of cross-linking between hook protein units.

Biological Sciences Category

Bio Sci Poster 9:

SURFACE INTERACTIONS OF LIPID BILAYERS WITH MUTANT Aβ PEPTIDES

Phillip M. Pifer and Justin Legleiter
C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV

One of the major features associated with Alzheimer's disease (AD), a late-onset neurodegenerative disease, is the ordered aggregation and accumulation of β-amyloid (Aβ) peptide into neuritic plaques that deposit on cellular surfaces in the brain. A key to understanding AD lies in elucidating the interaction between Aβ and the surface of a neuronal cell. The goal of this study is to determine the role of electrostatic interactions play in Aβ/lipid binding. *In situ* Atomic Force Microscopy was used to monitor the aggregation of Aβ as well as the integrity of the lipid bilayers over a 24 hour period. Supported brain lipid extract bilayers were used as physiologically relevant models of neuronal cell surfaces. Defect free lipid bilayers were systematically exposed to mutant forms of Aβ that are associated with familial forms of AD. These point mutations alter the charge of Aβ, providing an excellent system to explore the electrostatics underlying Aβ/lipid interactions. We observed that electrostatic interactions between Aβ and lipids influence Aβ aggregation, both kinetically and morphologically, leading to distinct alterations in bilayer integrity.

Bio Sci Poster 10:

Limb Kinematics of Adult Crayfish during Treadmill Walking

Sawan V. Prabhu and Jim H. Belanger
Department of Biology, West Virginia University

Procambarus clarkii, commonly known as freshwater crayfish, can travel effectively in both aquatic and terrestrial environments, although each location imposes different demands on the locomotor system. In terrestrial locomotion gravity is the predominant force, whereas aquatic locomotion is affected much more by both buoyancy and hydrodynamic forces. Fluid forces such as drag and lift are approximately 800-fold higher underwater. To study how these animals deal with such different environments, *P. clarkii* were videotaped with multiple cameras while walking freely on treadmills both on land and underwater. Marked points on the legs and body were used to track and reconstruct limb kinematics using Vicon Motus, a motion analysis system. Leg coordination was further studied by removing legs to determine the relative contributions of sensory feedback and central commands when generating locomotor rhythm. In the initial freely walking studies, the second set of walking legs showed higher angular rotation at the Thorax-Coxopodite joint than seen in the first set of walking legs.

Biological Sciences Category

Bio Sci Poster 11: (Only judge poster, presenter absent.)

Use of Mitochondrial Sequence Data for Detection of Error Rates for Calculations of Kinship using a Dominant Marker.

Ravi Viradia, Christine J. Picard, and Jeffrey D. Wells
Department of Biology, West Virginia University, Morgantown, WV 26506

Kinship detection is characterized in classifying individuals of the same species into groups according to their genetic profiles. A previous population genetic study on the carrion fly species *Phormia regina* (Diptera: Calliphoridae), using amplified fragment length polymorphism (AFLP) data has revealed that collections of blow flies have a larger than normal proportion of related individuals (Picard & Wells 2009). Distributions of relatedness coefficients for both the reference population as well as lab-generated full siblings showed overlap, and therefore a small proportion of individuals known to be unrelated had relatedness coefficients greater than the limit (R>0.15) for unrelatedness. It was our goal to sequence a mitochondrial DNA gene (cytochrome oxidase II) and compare the haplotypes within a sample for pairs of individuals with their corresponding AFLP-generated relatedness values. A total of 145 individuals have been sequenced including two sets of full siblings. All full siblings sequenced shared the same haplotypes, whereas the geographic samples yielded a total of 12 haplotypes. All pairwise comparisons of individuals of different haplotypes had relatedness coefficients < 0.15 indicating no relation.

Bio Sci Poster 12:

Exploring Genes for Application in Molecular Systematics of Eriophyoidea (Acari: Prostigmata)

Elizabeth Bolte and Mariam Lekveishvili
West Virginia University

The superfamily Eriophyoidea is composed of more than 3000 species, currently divided into three families. However, because eriophyoid mites are the smallest known, their systematics is not well studied. We will explore nuclear and mitochondrial genes for determining appropriate molecular markers for resolving phylogenetic relationships at different taxonomic levels. Cytochrome oxidase I (COI), a mitochondrial protein-coding gene, evolves quickly and is used to resolve relationships at species level; Elongation Factor 1α (EF-1α) is relatively slow evolving nuclear protein-coding gene, and is mostly used for resolving relationships at deeper nodes. Despite knowing the general uses of these genes, it is shown that in different organisms they evolve at different rates, including small groups within mites. Using several primer pairs, 12 taxa, including two outgroups, will be sequenced and analyzed for exploring the relationships within Eriophyoidea, testing the monophyly of the group, and determining sequence divergence. The information on the specific use of CO1 and EF-1α will benefit researchers involved in evolutionary and population studies by providing them with a more accurate way to generate phylogenetic topologies.

Biological Sciences Category

Bio Sci Poster 13:

The Impact of Feeding Behavior on Tsetse Fly (Diptera: Glossinidae) and Symbiont Biology

Brittany M. Ott, Anna K. Snyder, and Rita V. M. Rio
Department of Biology, West Virginia University, Morgantown, WV 26506

The hematophagous tsetse fly, the vector of African trypanosomes, harbors a simple microbiota essential to host survival. Although blood meals are obtained by tsetse from various sources, little is known regarding feeding behavior towards tsetse biology. We aimed to examine the impact of diverse blood meals on tsetse viability and symbiont fitness. Furthermore, we observe the effect of feeding on symbiont gene expression. We hypothesize that the symbiont heme and iron/manganese ABC transporters will be differentially expressed pre/post blood meal. Our experimental plan consisted of maintaining tsetse on equine, avian, or bovine blood and assessing survival through time. Whole fly DNA was extracted and symbiont density described through quantitative PCR. Transporter expression following blood meal acquisition was determined using reverse transcription. We observed greater tsetse survival on bovine blood relative to other blood sources, which may result from consequential variations in symbiont density. For symbiont expression analyses, a loading control and corresponding expression in 500 ng total fly RNA is described. These results enhance our understanding of tsetse biology and may promote novel control strategies.

Bio Sci Poster 14:

Population Structure and Clonality Assessment of *Populus tremuloides* in Yellowstone National Park

Rowlatt, A.E., A.M. Hnatkovich, S.P. DiFazio, and J.C. King
West Virginia University, Morgantown WV 26506

Populus tremuloides (trembling aspen) has the broadest geographic range of any forest tree species in North America. It is also the only deciduous tree species located in Yellowstone National Park. Regeneration of *P. tremuloides* is almost exclusively asexual via lateral root systems and sprouts. However, previous studies suggest that certain disturbance events, such as the 1988 fires in Yellowstone National Park, may provide an opportunity for rare episodes of sexual reproduction. Neutral, codominant genetic markers such as microsatellites may provide information regarding the nature of regeneration of *P. tremuloides* following natural disturbances. Genetic differentiation and clonality for four populations of post-fire (1988) *P. tremuloides* seedlings, distributed across the greater Yellowstone National Park area were assessed using microsatellite markers. This analysis provides insight into the extent of genetic structure and gene flow for select populations of *P. tremuloides*.

Biological Sciences Category

Bio Sci Poster 15:

Measuring Resurgence Through Time Allocation

Elizabeth Banta, Carlos R. X. Cançado and Kennon A. Lattal, Ph. D
Department of Psychology, West Virginia University, Morgantown, WV 26506 - 6040

In this replication experiment, time allocation to two different reinforcement schedules was used as a measure of resurgence in pigeons. Resurgence is the reoccurrence of previously reinforced behavior when extinction is arranged for other recently reinforced behaviors. During phases 1 and 2, reinforcers were given in the presence of the white or color keylight, respectively. On phase 3, extinction was in effect in the presence of both. Resurgence was observed in three out of four pigeons. For all pigeons, time allocation values matched arranged reinforcer proportions in both phases 1 and 2. Changeover rates of three out of four pigeons increased during phase 2 of the experiment and remained higher relative to phase 1. Resurgence was not observed for the same pigeon in both this experiment and the previous experiment. This indicates a bias towards the white key as more likely than a problem with discrimination of reinforcement proportions, as the previous experimenter suggested.

Bio Sci Poster 16:

A Novel Synthesis of 3-Hydroxycarbazoles

A.B. Stump and Bjorn Soderberg
C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV

Carbazoles are small tricyclic organic compounds consisting of two benzene rings connected by a pyrrole ring. Carbazoles are commonly used as dyes and most carbazoles have some biological activity (positive and negative). The aim of our research is to develop new methods of synthetically producing the compound 3-hydroxycarbazole. This compound has been experimentally shown to be an effective anticancer drug precursor. By coupling an iodocyclohexenone with an iodonitrobenzene, and fusing the resulting intermediate under the below specified conditions we were able to synthesize the desired 3-hydroxycarbazole product. The reactions have given us many different yields, but most consistently the yields stay around thirty percent as of this writing. Currently most work is being done on increasing that yield. Also steps are being taken to attempt to add substituents to the intermediate in order to create new compounds in the 3-hydroxycarbazole class.

Biological Sciences Category

Bio Sci Poster 17 (Only judge poster, presenter absent):

Carboxylesterase (hCE1) as a possible Bioscavenger against Organophosphorus (OP) Nerve Agents

Brooke E. Adams[2], James P. Lewis[2], Robyn Ayscue[1] and Peter M. Gannett[1]
[1] WVU, Pharmaceutical Sciences, Morgantown, WV, 26506
[2] WVU, Department of Physics, Morgantown, WV, 26506

The scientific community has recently expanded research towards nanoscience and biomaterials. The difficultly with understanding nanoscale interactions involves the unique physics that governs the atomic functionality. We are using a series of computational investigations involving molecular dynamics and empirical chemistry to enhance the fundamental understanding of the enzyme human carboxylesterase. Specifically, the potential use of carboxylesterase as a bioscavenger against toxic nerve agents in chemical warfare. The serine hydrolase mechanism of carboxylesterase is known to stiochemtrically bind to the organophosphorus nerve agents; however, the specifics of spontaneous reactivation, aging, and dormancy remain unclear. By analyzing the "structure-activity" relationship between the active site residues, the characteristics of carboxylesterase interactions may be better comprehended to expand the potential to serve as a catalytic scavenger against the warfare agents. We use modeling approaches to examine the specific nanoscale interactions between carboxylesterase and the nerve agents. Our current findings support the stoichiometric scavenger capabilities of carboxylesterase against nerve agents. This insight will help to expand the potential performance of a bioscavenger to effectively protect against organophosphorus warfare.

Bio Sci Poster 18:

Physiological response of medaka (*Oryzias latipes*) to South Branch Potomac River sediment extracts

Ben Laubender[1], Jana Woofter[2], Lisa Holland[2], and Jennifer Ripley-Stueckle[1]
[1]Department of Biology, West Virginia University, Morgantown, WV 26506, [2] Department of Chemistry, West Virginia University, Morgantown, WV 26506

Since 2002 in the South Branch Potomac River, extensive seasonal fish kills (i.e. > 80% mortality) and observations of intersex males (i.e. testes with oocytes) have invoked concern about the River's health. This research proposes to utilize a model fish species, Japanese Medaka *(Oryzias latipes)*, in combination with a novel sediment extraction technique to reproduce these conditions in the laboratory and to begin to identify specific contaminants responsible for these conditions and develop physiological measures indicative of exposure. Mating pairs were exposed for 14 days to ethyl acetate: acetone and hexane sediment extracts collected at two time points (April and May 2009). Exposure to sediment extracts collected in April reduced condition factor compared to controls. Heptaosomatic index did not differ with treatment. Vitellogenin and EROD will also be analyzed as physiological measures of environmental estrogen and general contaminant exposure respectively. This preliminary data indicates both the model species and extraction procedure are appropriate to begin to investigate the culprits affecting South Branch fishes.

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Agricultural and Environmental Sciences Category

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Poster 16: *Ascorbic acid deficiency induces constitutive hydrogen peroxide- and salicylic acid-dependent pathogen defense signaling.* Tyler S. Bedick[1], Madhumati Mukherjee[1], Katherine E. Larrimore[1], Naushin J. Ahmed[1], Nadia T. Barghouthi[1], M. Brian Traw[2], and Carina Barth[1]

Poster 17: *A Comparison of Antibiotic Alternative Products in Broilers.* Brittany D. McCutcheon and Kathryne L. Bucks

Poster 18: *Superhydrophobic Micropatterning of Polydimethylsiloxane Substrates.* Matthew Payne and Dr. Lloyd Carroll

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 1:

A Strategy to Identify Endocrine Disruption in the Potomac River

Jana L Woofter[1], Ben Laubender[2], Emily E Patterson[1], Stephanie Archer-Hartman[1], Lisa A Holland[1], and Jennifer Ripley-Stueckle[2]
[1]C. Eugene Bennett Department of Chemistry and [2]Department of Biology, West Virginia University, Morgantown, WV, USA

The Potomac River Watershed serves five million people in Maryland, Virginia, Pennsylvania, West Virginia, and Washington D.C. Fishkills, and intersexed smallmouth bass have been reported in the Potomac River. Environmental contamination triggers intersexing. Some chemicals are known endocrine disruptors, but many remain to be identified. The United States Geological Survey has tested suspect areas for a limited set of known contaminants. The reconnaissance is important, does not identify mixture toxicity or chemicals not yet listed as endocrine disruptors. The goals of this study are to (1) identify toxic sediment fractions first so future chemical analyses can be applied only to meaningful samples, and to (2) determine if river sediment plays a role in harboring endocrine disrupting chemicals. Sediment from the Potomac River was collected in the spring and summer of 2009. The sediment was processed and laboratory fish were exposed to the resulting extracts for two weeks. Following exposure, blood was collected, processed, and subjected to a new high-throughput analytical method to simultaneously profile multiple circulating steroids.

Ag & Env Sci Poster 2:

HYPOVIRUS TRANSMISSION THROUGH ASEXUAL REPRODUCTION IN CRYPHONECTRIA PARASITICA

Stephen Andrew Naymick II
Davis College of Agriculture, Forestry, and Consumer Science

The American chestnut tree was devastated in the last century by Cryphonectria parasitica, a fungus native to Asia. A virus, called a hypovirus, is being utilized to control the spread of chestnut blight. The hypovirus renders the blight fungus less virulent allowing the host to form healthy callus tissue, increasing its chances of survival. In Europe, chestnut blight has been effectively controlled by the natural spread of hypoviruses. The same effect has not occurred in North America despite the introduction of hypoviruses. To understand the transmission of hypovirus strains among C. parasitica, my study evaluated the extent of asexual reproduction containing hypovirus in an isolated stand of chestnut. Bark discs containing stroma from trees inoculated with hypovirus were evaluated to determine the percentage of hypovirulence. The data thus far shows that virulent conidia are produced in much larger quantity than to hypovirulent ones. However, in a few cases, some bark samples have nearly 66% of the asexual sporulation with hypovirus. These results show that in a few cases the hypovirus can spread dramatically through an active infected sight. Why this is happening at a slower rate in the U.S. as opposed to what has been reported in Europe has yet to be explained.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 3:

OPTIMAL PHOTOAUTOTROPHIC GROWING ENVIRONMENTS FOR *Chorella vulgaris*

Ben J Sade, Tabitha Amendolara, Mariana Farcas, and Dr. Alan Sexstone
Dept of Applied Environmental Microbiology, South Agricultural Sciences, Honors SURE, West Virginia University

Algae that contain lipids which can be extracted and used for the production of biofuels are an essential part of the demand for renewable fuels. *Chorella vulgaris* was batch cultured in Tris phosphate buffer media and Bushnell-Haas under varying conditions of light, pH, and CO_2 to test for optimal photoautotrophic growing environments. This species was chosen because of its ability to be easily grown, maintained, and manipulated in a laboratory setting. The number of cells in a milliliter of solution was important to assess the growth of the alga, and was thus determined using a hemacytometer and optical density to show relative cell numbers (±standard deviation). A phytoplankton analyzer was used to measure photosynthetic activity and electron transport rate of the alga. The results from these experiments will be used in the construction and maintenance of a continuous-culture bioreactor.

Ag & Env Sci Poster 4:

The Effect of Carbon Nanotube Exposure on Lysyl Oxidase Activity in Mouse Lung

John T. Barnard[1], Dr. Dale Porter[2] and Dr. Kenneth P. Blemings[1]
1. *Division of Animal and Nutritional Sciences, West Virginia University, Morgantown, WV, USA 2. National Institute for Occupational Safety and Health, Morgantown, WV, USA*

Carbon nanotube exposure has been linked to a fibrogenic response in the lungs and is believed to have similar physiological effects to asbestos exposure. Current research seeks to determine the molecular basis for the consequences of respiratory exposure to carbon nanotubes. One of the enzymes believed to be involved is lysyl oxidase. Lysyl oxidase catalyzes the final known step in the biosynthesis of normal extracellular matrices, and up-regulation of lysyl oxidase expression has been shown to result in an accumulation of insoluble collagen and elastin fibers leading to fibrosis. This investigation utilized a peroxidase coupled fluorometric assay to detect variations in lysyl oxidase activity in the lungs of mice that have or have not been exposed to carbon nanotubes. Preliminary testing indicates that the Km of lysyl oxidase for free lysine is 8.9 mM. Increased lysyl oxidase activity in the lungs of mice that were exposed to carbon nanotubes compared to those that were not exposed would suggest that lysyl oxidase is involved in the fibrogenic response associated with respiratory carbon nanotube exposure.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 5:

SAVING THE ENVIROMENT TWO STEPS AT A TIME: MRE FOR DEET AND BIODISEAL ANALYSIS

Saba Ashfaq, Anthony Giovengo, and Letha J. Sooter*
Department of Biology, West Virginia University, PO Box 6057 Morgantown, WV 26506-6057

Reliable detection of pesticides is a concern for biologists who are helping endangered wildlife and for those who are concerned with the health of human beings because of the pollutants in the environment. Convenient, on- site analysis of bio-molecules is possible with biosensors. With the use of *in vitro* selection techniques, a library of single-stranded DNA or peptides can be screened for target binding molecules, or molecular recognition elements (MRE), for a biosensor. Preliminary data and controls were collected from Polymerase Chain Reaction and gel electrophoresis. MRE's are the key to detect a pesticide like N,N-Diethyl-meta-toluamide (DEET). DEET is an active ingredient in insect repellents and has affected wildlife in water.

Another concern to biologists is the pollution from fossil fuels. Biodiesel is an excellent substitute, because it's a renewable fuel, does not contribute to the net increase of carbon dioxide and can be synthesized from waste or new vegetable oils. Biodiesel was produced from both sources. Quality tests were performed on the biodiesel including visual clarity, viscosity, cloud point, gel point, and methanol tests.

Ag & Env Sci Poster 6:

Diversity of Pollinator Insects in Natural and Agricultural Ecosystems

Adrya Webb, Vicki Kondo, and Yong-Lak Park
Entomology Program, Division of Plant and Soil Sciences, West Virginia University, Morgantown, WV 26506

Our future flies on the wings of pollinators. With the decrease in numbers of honeybees due to colony collapse disorder (i.e. a phenomenon in which individuals of a honey bee hive or colony abruptly disappear) it is becoming a great concern for pollinations in natural and agricultural ecosystems. This study was conducted to investigate the species diversity and richness of pollinator insects in four sites throughout West Virginia. The sites included an orchard, a pasture field, a public park and a wildlife restoration area. Sampling was conducted with sweeping and trapping, and diversity of pollinator insects were investigated with various diversity indices. We found that dominant pollinator species were bumble bees, leaf cutter bees, flower beetles, and flower flies in the study sites. Results also showed that there were alternate pollinator insects of which populations can be managed to provide supplemental pollination in addition to honeybees. This study reported a list of supplemental pollinator insects in various ecosystems.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 7:

Hypovirus Transmission into Asexual Spores of American Chestnut Blight in Pendleton County, West Virginia

Matthew Malone, William L. MacDonald, and Mark Double
Division of Plant and Soil Sciences,
West Virginia University, Morgantown, WV, 26506

The fungus, *Cyphonectria parasitica,* is responsible for the demise of American chestnut in the eastern forests of the United States. The fungus, first found in New York City in 1904, is native to Asia. In Europe, naturally occurring viruses, called hypoviruses, act as a biological control for this disease. In North America, this biological control does not occur naturally. Ideally, the infecting hypovirus should be transmitted to a high number of asexual fungal spores in order to affect the maximum level of biological control. This experiment was conducted to evaluate the dissemination of the hypovirus into the pathogen's asexual spores. Bark samples were collected from cankers at a field site in Pendleton County, WV, where hypovirus strains were being released to evaluate their dissemination. The samples were soaked in water for 20-30 minutes prior to their examination under a microscope. Pycnidia (fruiting bodies that contain conidia) were identified on the bark surface and squashed with a needle probe. The contents were mixed in a 0.1% peptone solution and serially diluted onto Glucose-Yeast Extract medium amended with antibiotics chlortetracycline (100 mg/L) and streptomycin sulfate (10 mg/l). After a forty-eight hour period of incubation, single germlings were then transferred to a Potato Dextrose Agar medium and incubated at 20^{o} C for 14 days after which the isolate morphology was recorded. Preliminary results indicate that hypoviruses are present in 30% of the samples examined. Of the cankers that yielded hypovirus-infected spores, 39% of conidia contained hypovirus; ranging from 18-75%. These data indicate that hypoviruses are transmitted into conidia at varying rates. This inconsistency may have an impact on biological control.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 8:

Does acidification affect the growth of young growth forests?

Eric Winter, Zack Fowler and Dr. Bill Peterjohn
Department of Biology, West Virginia University, Morgantown, WV 26506

Since the industrial revolution, anthropogenic inputs to ecosystems of reactive, biologically available global Nitrogen have doubled due to heavy industry and burning of fossil fuels. These increases may affect tree growth by initially stimulating growth due to reduced nitrogen limitation but eventually causing decline through base cation depletion and increased soil acidity. Nitrogen additions in the Fernow Experimental Forest (FEF) at the watershed level have shown species specific, time sensitive growth for key timber species and for ecologically important trees in the area. Long Term Soil Productivity (LTSP) plots examine watershed results on a smaller, replicable scale. Treatments include whole tree harvesting (WT), WT+Ammonium Sulfate (NS) and WT+NS+Lime. We hypothesize that differences in tree growth due to treatment will be detected 13 years into the LTSP study. Belowground biomass will be calculated by harvesting standing rootstock and basal area will be measured to calculate aboveground biomass. Change in growth affects a forest's ability to sequester carbon and harvest for timber, thereby, affecting future ecological and economic services of mid-Atlantic forests.

Ag & Env Sci Poster 9:

Localization of ergot alkaloid production in the pathogenic fungus *Aspergillus fumigatus*

Natalie A. Allen, Shanthi Mulinti, and Daniel G. Panaccione
Division of Plant & Soil Sciences, West Virginia University, Morgantown, WV 26506-6108

Aspergillus fumigatus, a common fungus and opportunistic human pathogen, produces toxic ergot alkaloids. Only sporulating cultures produce ergot alkaloids, and mature spores (conidia) and whole conidiating cultures (containing four cell types: vegetative hyphae, vesicle of conidiophore, phialides of conidiophore, and conidia) produce different profiles of ergot alkaloids. Based on these observations we hypothesize that expression of ergot pathway genes varies by cell type. Analyses of different cell-type mutants support this hypothesis. Cultures of the "stunted" mutant (*stuA*), which lack the two cell types that make up the conidiophore, produced no ergot alkaloids. Cultures of the "medusa" mutant (*medA*), which contain excess phialides on its conidiophores, accumulated more ergot pathway intermediates than end product when compared to wild type. To better visualize the cellular and intracellular location of ergot alkaloid production, *dmaW* (the initial gene of the ergot pathway) was tagged with a green fluorescent protein (GFP) gene and expressed in *A. fumigatus*. Mutant studies demonstrated cell-type variation in the ergot pathway; the GFP-tagged strains we engineered will provide further detail on ergot pathway localization.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 10:

Optimal Conditions for Photoautotrophic Growth of *Chlamydomonas reinhardtii*

Tabitha A. Amendolara, Benjamin J. Sade, Mariana T. Farcas, and Alan J. Sexstone,
Division of Plant and Soil Sciences, Davis College, West Virginia University, Morgantown, WV 26506

The unicellular green alga, *Chlamydomonas reinhardtii*, uses photosynthesis to capture light energy for CO_2 fixation and biomass production. A portion of its biomass accumulates as triacylglycerols, which can be harvested to produce biodiesel transportation fuels. The development of algae-derived biofuels could potentially decrease the amount of CO_2 emitted by the transportation sector. In laboratory experiments, we investigated optimal growth conditions for *C. reinhardtii* by varying culture pH (4-10), carbon dioxide concentration (0.03%-10%), and light intensity (50–2,000 µmol photons m^{-2} s^{-1}). Pure cultures were grown under photoautotrophic conditions in triplicate photobioreactors containing Tris-phosphate and Bushnell-Haas media over a 4-6 day period at 25º C. Growth was analyzed through measurements of optical density, photosynthetic efficiency, and biomass yield. Optimal growth rates and biomass yields were obtained using Bushnell-Haas media at pH 5, 6% CO_2 concentration, and 100 µmol photons m^{-2} s^{-1}. Under these conditions, biomass, and thus lipid yield, can be maximized for future experiments in algal biofuel production.

Ag & Env Sci Poster 11:

Assessment of remotely sensed imagery as a means of detecting the impact of disturbance history on forest canopy structure and chemistry.

Curtis, Philip G., Deel, Lindsay N., and McNeil, Brenden E.
Department of Geology and Geography, West Virginia University, Morgantown, WV 26506

In recent years Landsat satellite data has been used to measure forest disturbance on a regional scale. We created disturbance maps of the Savage River State Forest (SRSF), Maryland, in order to assess how well satellite imagery can reveal the impact of disturbance history on forest canopy structure. Our maps highlight the location and intensity of disturbances that occurred in the SRSF between 1984 and 2007. After comparing these disturbance maps to canopy structure data that we collected within the SRSF during 2009 and to disturbance records from state foresters we were able to assess the ability of remotely sensed imagery to reveal the impact of disturbance history on forest canopy structure. Accordingly, our maps provide a new tool to map the impact of disturbances on canopy structure, and thereby understand the role of past disturbances on forest processes such as photosynthesis, which can alleviate climate change through the absorption of atmospheric carbon dioxide.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 12:

Infestation levels and spatial distribution of beech scale in the Monongahela National Forest.

Ariel Diliberto, Dave McCann, William MacDonald, and Yong-Lak Park
Entomology Program, Division of Plant and Soil Sciences, West Virginia University, Morgantown, WV 26506

Infestation of American beech *Fagus grandifolia* Enrh. (Fagales: Fagaceae) by beech scale insect *Cryptococcus fagisuga* Lind. (Hemiptera: Eriococcidae) facilitates infection by pathogenic *Neonectria* fungi. We developed a protocol to assess beech scale infestation. We also investigated the spatial distribution of beech scale in a stand with an American beech component in the Monongahela National Forest. A four-level visual qualitative rating was devised and quantified by calculating the number of beech scale at each infestation level on 6.45cm^2 bark samples. This rating was used to map the spatial distribution of beech scale with geospatial methods including geographic information system (GIS), global position system (GPS), and geostatistics. We found a significant linear relationship between the qualitative visual rating and the actual number of *C. fagisuga* (df = 1, 3; F = 49.54; p = 0.02; r^2 = 0.94). Geostatistical analyses and spatial mapping demonstrated relationships of *C. fagisuga* infestation to aspect of bark surface and tree size. These results could provide insight for future research and management of stands affected by this insect-disease complex.

Ag & Env Sci Poster 13:

Effects of Nitrogen Deposition on Magnesium Dynamics in Oak versus Mixed Litter Decomposition.

Kristen L. Magnuson, Prinith S. Munasinghe, and Kathryn B. Piatek
Department of Forestry, West Virginia University, Morgantown, WV 26505

Increases in atmospheric nitrogen (N) deposition over past decades raise concern over N retention and nutrient cycling in forest ecosystems. In the US, research into acid deposition has focused more on the leaching and cycling of calcium (Ca) rather than magnesium (Mg), though the two elements are similar in many respects. Further, widespread forest decline in the 1980s in Germany was attributed to Mg deficiencies due to acidic deposition. We conducted a litter decomposition study at the Long-Term Soil Productivity (LTSP) site at the Fernow Experimental Forest in West Virginia. The LTSP site has plots of regenerating stands growing under ambient deposition, experimentally-elevated deposition, and elevated deposition plus dolomite. Fresh litter was collected from treatment plots in November, bagged, and placed in the field in March as oak or oak-and-native mix. Mg dynamics during litter decomposition was followed for 32 months. We expect Mg dynamics to be similar to Ca dynamics observed under the same conditions, but a difference could indicate that Mg is a limiting nutrient in the system.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 14:

The Effects of Elevated Temperature and Nitrogen Fertilization on Carbon Balance of Canaan and Fraser Fir

Charles H.H. Parsons, Kenneth R. Smith, and Richard B. Thomas
Department of Biology, West Virginia University, Morgantown, 26506

Due to geographical constraints on species distribution we hypothesize that refugial populations of coniferous trees may sensitive to small changes in temperature and thus, these species may serve as indicators of global climate change. In our study we conducted a greenhouse experiment to determine the effect of increasing temperature and nitrogen fertilization on both photosynthesis and respiration rates in two fir species, *Abies fraseri* and *Abies balsamea* var. *phanerolepis*. Each species was grown in greenhouses set to ambient and elevated temperature regimes (25/20° and 30/25° day/night, respectively). Nitrogen availability was controlled through the addition of nutrient solutions of varying concentrations (0.4 mM N and 1.6 mM N). Preliminary gas exchange results show no significant difference between treatments. However, trees grown under higher temperatures have shown a significant decline in overall growth based on empirical observation. While a temperature effect has been observed, future studies will need to be conducted to determine the extent to which these species are responding.

Ag & Env Sci Poster 15:

Zinc Induced Oxidative Stress Responses in Hybrid Poplar

Daniel Paul, Ernest Smith, Dhiraj Naik, and Jonathan Cumming
Dept of Biology, WVU

High external zinc concentrations increase internal concentrations of reactive oxygen species (ROS), causing an increase in oxidative stress and a disruption of homeostasis. Poplar trees possess many anti-oxidant (AOX) enzymes that mitigate the effects of ROS. This experiment measures antioxidant activity in zinc-stressed poplar trees to better understand plant responses to heavy metal generated ROS. This understanding could yield a more effective application of poplar trees for phytoremediation. A treatment range of 2mM-10mM zinc was applied for five days. Leaf and root sections were assayed spectrophotometrically to determine the extent of oxidative stress through lipid peroxidation, as well as antioxidant enzyme activity of ascorbate peroxidase (APX), catalase (CAT), glutathione reductase (GR), guiacol dpendent peroxidase (GPX), and superoxide dismutase (SOD). Expected results include observing an increase in AOX enzyme activity and lipid peroxidation with increasing zinc concentration. We hypothesize that poplar can increase AOX enzyme activity in response to ROS-induced lipid peroxidation.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 16:

Ascorbic acid deficiency induces constitutive hydrogen peroxide- and salicylic acid-dependent pathogen defense signaling

Tyler S. Bedick[1], Madhumati Mukherjee[1], Katherine E. Larrimore[1], Naushin J. Ahmed[1], Nadia T. Barghouthi[1], M. Brian Traw[2], and Carina Barth[1]
[1]Department of Biology, West Virginia University, Morgantown, WV 26506, [2]Department of Biological Sciences, University of Pittsburgh, Pittsburgh, PA 15260

The ascorbic acid (AA; vitamin C)-deficient *Arabidopsis thaliana* mutant *vtc1-1* exhibits increased resistance to the virulent bacterial pathogen *Pseudomonas syringae*. This response correlates with heightened levels of salicylic acid (SA), which induces antimicrobial pathogenesis-related (*PR*) proteins. To elucidate the mechanism of this enhanced disease resistance, the four AA-deficient *vtc1-1*, *vtc2-1*, *vtc3-1*, and *vtc4-1* mutants were studied. The SA content, hydrogen peroxide (H_2O_2) amount, and transcript levels of defense genes were determined in *vtc* mutants in the presence and absence of *P. syringae*. To determine through which pathway SA is synthesized, double mutants containing a defect in *vtc1-1* and in SA biosynthesis or signaling genes were examined for their SA content and ability to resist *P. syringae*. All *vtc* mutants are more resistant to *P. syringae* than the wild type. This correlates with constitutively upregulated H_2O_2, SA and mRNA levels of *PR* genes. Double mutant analysis revealed that *vtc* mutants accumulate SA through the isochorismate synthase pathway. We conclude that AA deficiency causes a constitutive buildup of H_2O_2 that stimulates SA accumulation conferring enhanced disease resistance.

Ag & Env Sci Poster 17:

A Comparison of Antibiotic Alternative Products in Broilers

Brittany D. McCutcheon and Kathryne L. Bucks
Division of Animal and Nutritional Science
West Virginia University, Morgantown, WV 26506

The production of poultry accounts for over 50% of all agricultural commodities in West Virginia. Antibiotic resistance is a significant problem in production animal agriculture that may pose risk to human health. Certain bacteria that were at one time sensitive to particular antibiotics are now becoming progressively more resistant. Sub-therapeutic levels of antibiotics are commonly incorporated into livestock feeds to promote growth and to ward off potential infections. Due to ever increasing US animal production and subsequent high volume use of antibiotic containing feed an ideal situation is created for antibiotic resistance. Thus, antibiotic alternatives need to be discovered and incorporated into livestock feed. The different alternatives chosen for comparison to the antibiotic BMD are Biostrong, Biomoss, Natustat, and Galliacid. This study on Cobb 500 broiler chickens will be used to compare and contrast the effectiveness of five feed additive alternatives to a common antibiotic in poultry feed. The results, thus far, have shown that the chickens are growing, and the mortality rate for the treatment containing Galliacid is the lowest. Through bacterial quantitative analysis, Biostrong is most effective. Factors that will be measured are feed intake, live weight gain, feed conversion ratio, morbidity, mortality, bacteria resistant populations, and oxidative stress levels.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 18:

Superhydrophobic Micropatterning of Polydimethylsiloxane Substrates

Matthew Payne and Dr. Lloyd Carroll
WVU C. Eugene Department of Chemistry

Many modern power plants utilize natural draft cooling towers to condense and recycle the water necessary for their operation, yet a significant portion of this water is still lost as aerosol particles to the atmosphere. The goal of this project was to prepare a variety of different sizes of repeating hydrophobic/hydrophilic microsquare patterns on PDMS substrates to investigate the possibility of using such surfaces to condense and recycle additional water. A master mold was initially prepared for each pattern size using photolithography with custom designed polyester film masks to create raised SU-8 microfeatures on a silicon substrate. PDMS was poured over these molds to create stamps with extruded patterns which were then stuck to the final PDMS substrates to shield contacted areas from initial liquid reactants. The stamps were then removed to allow reaction of the previously covered surfaces. Goniometric testing allowed the hydrophobicity of the prepared samples to be quantitatively analyzed and provided useful insight into the potential utility of such surfaces in future water recovery systems.

Physical Sciences and Engineering Category

Phys Sci & Eng Index

Physical Sciences and Engineering Category

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Physical Sciences and Engineering Category

Phys Sci & Eng Poster 1:

Photonic Crystal Simulation and Comparison for Fluorescence Enhanced Optical Biosensor

Jason J. Jackson and Dr. Jeremy Dawson
College of Engineering and Mineral Resources, West Virginia University, Morgantown, WV 26506-6070

The need for cheap, portable, highly sensitive and selective sensors is prevalent for many applications in today's word. Our main goal is to create a photonic crystal (PhC) transducer to enhance the fluorescence of labeled bio-molecules or other materials to meet this growing demand. My research goals are to determine the optical properties of fabricated PhCs using MIT Photonic Bands, and then compare the optical band structure of 'ideal' device parameters used during the design phase and actual fabricated parameters that include slight errors in feature size. Another goal of my research is to explore the use of polydimethylsiloxane (PDMS) as a PhC material, which shows promise of allowing cheaper and faster fabrication when co-integrating PhC devices with microfluidics in lab-on-a-chip systems. Results showed that the optical band structure of the fabricated crystal shifted from an ideal center-gap value of 956.66 nm to 939.73 nm. PDMS simulations showed a band gap from 600 nm to 576.92 nm for Transverse Electric (TE) polarization, with no gap for Transverse Magnetic (TM) polarization. In conclusion the principal findings where that band gaps will shift with minor changes in parameters from simulation to fabrication and that band gaps do exist in (TE) for PDMS.

Phys Sci & Eng Poster 2:

Acquisition and Understanding of Biometrics in the Short-Wave Infrared (SWIR)

Jason Grant, Zain Jafri, Cameron Whitelam, Thirimachos Bourlai, and Lawrence A. Hornak
Center for Identification Technology Research
West Virginia University, Morgantown, WV, 26506

Determining human identity and patterns of activity in outdoor environments is an important capability for security and military applications. Current research emphasizes performance improvements of biometric systems operating under solar or indoor illumination. Our research focuses on the extraction, processing, and matching of biometrics acquired in night environments in the presence of available natural or artificial illumination. The short-wave infrared (SWIR) spectrum (900nm-1600nm wavelength) is of interest for night environments because of existing optical sources and potential complementary image information. In this study we focus on face image acquisition and fundamental understanding of the information revealed from visible through SWIR bands. Multispectral face images were acquired using visible, near-infrared, and SWIR cameras under broadband illumination. Images were collected in 100nm wavelength bands from visible through SWIR. Design of narrow-band wavelength illuminators was also undertaken. Using optical modeling software and hardware configurations, we

constructed a diverging beam expander to illuminate an area 3-5m wide at 25m capable of capturing human activity. The design of our multispectral acquisition protocol and process will be reviewed and representative data from the collection will be presented along with its initial analysis.

Acknowledgements: This work is sponsored in part by the Office of Naval Research Grant N00014-08-1-0895, and the National Science Foundation Industry/University Cooperative Research Centers (I/UCRC) Program through a Research Experiences for Undergraduates (REU) Supplement to grant IIP-0641331.

Phys Sci & Eng Poster 3 (two projects on one poster):

Short analysis of national healthcare expenditures (1961-2007)

Noemi H. Borsay and Dr. Gerald Hobbs
Department of Statistics
West Virginia University
Morgantown, WV 26506

As healthcare prices go up and our economy takes a dip, interest in government spending on healthcare increases. Dr. Jack Riggs, vice chair of the Department of Neurology at West Virginia University, collected most of the data used in this analysis. The purpose of analyzing this data was to see if any interesting conclusions could be made about national healthcare expenditure over a period of 46 years. Using Microsoft Excel and a statistical computing program, JMP, a number of formulas were created using the raw data. Percentages were calculated as well as the changes from year to year and decade to decade. These amounts were then compared using graphs and multivariate regression. Results show that the rising cost of healthcare in America is not directly linked to the increasing 65+ population of the US. Even as the proportion of older Americans decreases, the NHE continues to increase. Other factors are definitely at play, though they fall out of the scope of this study.

COMPARING ONE-COLOR AND TWO-COLOR ANALYSIS OF MICROARRAYS

Noemi H. Borsay and Dr. James Denvir
Department of Statistics
West Virginia University
Morgantown, WV 26506

Researchers at Marshall University recently conducted microarray experiments on an in vitro cancer cell line of interest. RNA was extracted from the cell line and from the same cell line with the gene of interest knocked out. To normalize the data, the expression levels of each were divided by that of a universal reference RNA. The ratios were then compared and analyzed to find statistically significant genes. The researchers expressed an interest in comparing the results of the two-color analysis with that of a one-color analysis. In a one-color analysis, the

universal reference RNA is not used, but the data is normalized using quantile normalization. The data were isolated, filtered, and normalized using computer programs. Following a significance analysis of microarrays (SAM), the results of the one-color analysis and two-color analysis could then be compared and analyzed to see if the same genes were regarded as significant under both processes. Up to this point, comparing the two analyses has shown similar results, though further analysis must be conducted before a conclusion can be made.

Phys Sci & Eng Poster 4:

On Facial Vascular Feature Extraction using Thermal Imaging

Nnamdi C. Osia, Thirimachos Bourlai, and Arun Ross
CITeR, College of Engineering and Mineral Sciences, Engineering Sciences Building East Wing, West Virginia University, Morgantown, WV, 26505

Face recognition is a rapidly growing research area due to increasing demand for security applications. The majority of the current approaches to face recognition are based on two-dimensional images in the low (visual) or middle infrared (IR) spectra. However, all these methods rely on facial characteristics that are on or over the skin. These current methods do not address low permanency problems, and environmental factors (e.g., bad lighting). In this work we provide with design as well as algorithmic improvements of an established face recognition framework operating in the long wave IR (thermal) spectra. It is based on physiological information and capitalizes on the uniqueness of the innate vasculature that is under the skin. To establish feasibility, the algorithm initially reads the appropriate thermal video files provided by [2]. We then provide with fully customized thermal colormaps and employ a more efficient anisotropic diffusion technique [3]. Finally, we optimize the morphological operators employed in order to obtain a more robust vascular network. Experimental results suggest that all goals were met, and possibilities for further experimentation are established.

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ACKNOWLEDGEMENTS

We would like to thank the National Science Foundation (NSF) Research Experiences for Undergraduates (REU) for financial support. We would also like to thank the Office of Naval Research for supporting this work. Special thanks are due Dr. Larry Hornak of the Center Identification for Research and Technology (CITeR) at West Virginia University for his support and valuable guidance throughout.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 5:

SOLUTION-PHASE CHEMICAL SYNTHESIS OF BOWL-SHAPED BUCKMINSTERFULLERENE FRAGMENTS

Cynthia G. Bollinger, Hu Cui, and Kung K. Wang
C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV 26506-6045

Buckminsterfullerenes, commonly referred to as buckyballs, are the third elemental form of carbon following diamond and graphite. In the case of C_{60}, the structure contains twelve 5-membered rings connected head-to-head with each surrounded by five 6-membered rings, resembling a soccer ball. In nature, these molecules are quite stable and often found in soot. The only effective way they have been synthesized in a lab is under the extreme conditions of flash vacuum pyrolysis (FVP) which involves very high temperatures and low pressures. Unfortunately, yields are generally low using FVP. This is why new solution-phase chemistry methods of synthesis are needed. The benefits of these new processes are that commercially available reagents and lower temperatures can be used to form buckyballs. For this research, the initial steps of a new synthetic process were tested. The preliminary results indicate that the designed synthetic scheme is feasible in serving as a potential pathway for the preparation of buckminsterfullerenes. If this entire process is completed, it will be a major advancement in producing buckminsterfullerenes.

Phys Sci & Eng Poster 6:

Hydrothermal Synthesis of Lanthanum Titanate Nanosheets as a Photocatalyst for Conversion of CO_2 to Chemical Commodities

James R. Arndt, III, Fanke Meng, Mingjia Zhi, and Nianqiang Wu
Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506-6016

Carbon dioxide is an environmentally harmful byproduct of many industrial processes. The objective of this research is to hydrothermally synthesize and characterize a metal oxide nanosheet photocatalyst for conversion of CO_2 to chemical commodities. Lanthanum titanate ($La_2Ti_2O_7$) was selected as the photocatalyst candidate in the present work. The hydrothermal temperature and duration, as well as the NaOH concentration were varied to optimize the hydrothermal process. Scanning electron microscopy showed that the hydrothermal product was composed of the nanosheets of varying dimensions. The crystallinity of the $La_2Ti_2O_7$ nanosheet was improved by the calcination of the hydrothermal product at 700°C. The UV-VIS spectrum showed that the sample absorbed the ultraviolet up to the wavelength of 470 nm. Future steps include the improvement of photocatalytic properties.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 7:

RECHARGEABLE LITHIUM-ION BATTERY: LITHIUM-MANGANESE-PHOSPHATE NANOFIBER CATHODE

Amber L. Bartlett, Mingjia Zhi, and Dr. Nick Wu
Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV, 26506-6106.

Porous nanofiber cathodes have shown promise in rechargeable lithium-ion batteries (such as those in cellular phones) due to their high surface-area-to-volume ratio. This property allows for the attachment of more lithium ions for a given amount of cathode material, promoting a higher energy density.

Solutions containing lithium, manganese, phosphorous, and oxygen, in addition to a polymer, were formed into nanofibers using electrospinning, a process of pumping the solution through a high-voltage electric field onto a conducting collection plate. These nanofibers were stabilized and carbonized, and then examined with an SEM for fiber morphology, and an XRD for material characterization. Preliminary tests have yielded several solutions that produced nanofibers when electrospun and heated.

Future testing entails inserting the fabricated cathode material into a battery-testing machine, which subjects the material to numerous charge/discharge cycles to determine its reversibility. The production of these porous cathode nanofibers could lead to longer-lasting, lighter-weight lithium-ion batteries. The use of lithium manganese phosphate instead of typically used lithium cobalt oxide in cathodes will have positive ramifications on the environment.

Phys Sci & Eng Poster 8:

ENCAPSULATION OF ORGANIC LIGHT-EMITTING DIODES FOR INCREASED LONGEVITY

Allison Krumanacker[2], Dr. Andrew Cao[1], Dr. Gaoyu Zhong[1], and Yiqiang Zhang[1],
1. Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV, USA.
2. Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV, USA.

Organic light-emitting diodes (OLEDs) have the potential to replace current LCD displays due to their more versatile nature. OLEDs function without the aid of a backlight and also draw much less power[1]. OLEDs also have the potential to perform with 100% efficiency[2]. However, there is one main drawback to their use. The organic layers within the LED are extremely susceptible to oxygen and water, causing the OLED to degrade quickly. This research seeks an efficient way of encapsulating the OLED so as to increase its lifetime. Current experiments utilize an encapsulation lid formed from a cut glass microscope slide and a silicon wafer. The lid is then attached to the glass substrate containing the OLED by using epoxy. The

attachment of the lid is done within a nitrogen-filled, controlled-atmosphere glove box. This all but eliminates the oxygen trapped within the device during the encapsulation process. Future experiments will be conducted with custom glass lids containing a form of desiccant placed within the encapsulated device.

1. “Organic Light-Emitting Diode,” Wikipedia.com, (2009).
2. "Light-Emitting Diode," Microsoft® Encarta® Online Encyclopedia 2009 http://encarta.msn.com © 1997-2009 Microsoft Corporation. All Rights Reserved.

Phys Sci & Enq Poster 9:

Biomimetic growth and characterization of calcium carbonate polymorphs.

Adam M. Sadowski and R. Lloyd Carroll
C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV.

Living organisms have developed efficient techniques to direct the growth of inorganic crystalline materials as structural elements. Previous research has shown that solution modifiers with specific side chains play a critical role in directing crystalline structure and morphology of calcium carbonate biominerals. Similarly, this evidence suggests that the use of synthetic, biological, and inorganic molecules, with analogous side chains, should allow for the control of crystal growth in non-living systems. This research examines the effects of amino acids: cysteine, aspartic acid, and glycine, and inorganic polymers: polyvinyl alcohol and polyacrylic acid, on the growth of calcium carbonate via a unique novel vapor diffusion-based and enzymatic growth technique. Through the use of a gas permeable membrane, polydimethylsiloxane, we are able to control crystal growth, orientation, and morphology. Probe microscopy, scanning electron microscopy, XPS, and infrared and raman microscopic spectroscopy were utilized to differentiate between polymorphs and to investigate the actions of the solution modifiers. This area of study has potential significance in industries which rely on the material including pharmaceutical development, household products, and biological insight.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 10:

Change in Coercivity of Cobalt/Palladium Multilayers from Hydrogen

Samuel Ducatman, Kineshma.Mundobh, Felio Perez, and David Lederman
Grinnell College and Department of Physics, West Virginia University

Hydrogen absorption affects magnetic properties of ferromagnetic thin films with potential use in computer memory. We measured the effect of hydrogen absorption on magnetic and transport properties of cobalt/palladium multilayers on an Al_2O_3 (110) substrate. They were mounted inside a Vibrating Sample Magnetometer in both hydrogen and helium atmospheres. The coercivity values for angles between 0 and 90 degrees with respect to the magnetic field were calculated. These were also mounted inside a Tesla magnetic field, and resistance was measured using the configuration at the same angles relative to the field as before. A strong magnetoresistance effect was found. Coercivity was the maximum of the derivative of resistance versus magnetic field strength. Coercivity values obtained by two methods agreed, ranging from slightly over 0 T to 0.4 T. A trend was found for the coercivity difference between hydrogen and helium measurements, which peaked between 15 and 30 degrees. Hydrogen absorption has significant effects on the magnetic properties of cobalt/palladium multilayers. This might apply to producing sensitive hydrogen detectors for potential use to improve computer memory.

Phys Sci & Eng Poster 11:

MULTIMODAL BIOMETRIC IDENTIFICATION USING SHORT-WAVE INFRARED IN NIGHTIME CONDITIONS

Zain F. Jafri*, Cameron F. Whitelam*, Jason Grant**, Thirimachos Bourlai*, and Lawrence Hornak*
**Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV 26506*
***Computer Engineering, University of Maryland, Baltimore County*

Data is being collected to perform biometrics in a night setting. This is done by actively illuminating a scene (1 meter to 100 meters) to observe both hard and soft biometrics—face, iris, and gait. This illumination is in the short-wave infrared spectrum between 950 and 1650 nanometers. Band pass filters at wavelengths centered 100 nanometers apart (950, 1050, etc.) are used to find which wavelengths provide the best quality images to perform biometric matching algorithms. This is determined by finding the wavelength(s) that produce the highest match scores. A series of pictures are taken of each subject at each wavelength. The subject then comes back approximately a week later and has the same pictures taken again. This allows for a variety in appearance, which allows the biometrics systems to be tested as in real-world applications. One set will be used as a database, while the other set will be used as field data. This research is being performed for military applications such as monitoring appropriate situations at night without any visible exposure.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 12:

De Novo Asymmetric Synthesis of Mezzettiaside 8

Ian A. Townsend, Miaosheng Li, and George A. O'Doherty
C. Eugene Bennett Department of Chemistry, West Virginia University

The development of a de novo asymmetric approach to the trisaccharide mezzettiaside 8 from acetyl furan is in progress. The synthesis of mezzettiaside 8 will be divergent, potentially leading to the syntheses of the related isomers, mezzettiasides 2,3,4,9, and 11. All six of these oligosaccharides display significant cytotoxic activity against a panel of human cancer cell lines, specifically those associated with lung and colon cancers (1). Our approach to the construction of these carbohydrate natural products has thus far consisted of a Noyori reduction, palladium-catalyzed glycosylation, Luche reduction, DCC coupling, and Upjohn dihydroxylation. The products have been confirmed using 270 Mhz. NMR and purified using silica gel chromatography. Related reactions will be utilized to complete the mezzettiaside, along with the required regioselectivity to install the final acylation pattern.

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Phys Sci & Eng Poster 13:

SEARCHING FOR FOURIER CONSTANTS IN THE HALLS OF A TRAVELING ELECTROMAGNETIC WAVE

James Eakins and Dr. Boyd Edwards
Department of Physics, West Virginia University
Morgantown, WV 26505-6045

Separation is a key component in detection for medical devices, allowing easier detection for diseases. Using a micro fluidic channel lined with electrodes, it is possible to create a traveling electric wave field that can separate particles based on the mobility of the particles in the fluid. The electric potential at the electrodes can be made by using logarithmic functions. This research is to determine the Fourier coefficients required to transform the potential equation into trigonometric functions, which are more easily read by computers. Because of the channel walls, image charges are created in the vertical directions for every electrode in the horizontal direction, which for this application is considered to be an infinite number. The Mathematica computer program can help to symbolically integrate the extremely complicated equations, aiding in the transformation. Symbolically, the constants will allow for modeling of the system over a wide range of variables. This has proven to be difficult, and a numerical method could be attempted. This will open research for motion of the particles being separated.

Physical Sciences and Engineering Category

Phys Sci & Enq Poster 14:

Three Component Coupling Reaction Catalyzed by Triazole-Au(I) Complexes

Suzan Bilgesu, Sujata Sengupta, and Dr. Xiaodong Micheal Shi
C. Eugene Bennett Dept. of Chemistry, West Virginia University, Morgantown, WV 26505

To further evaluate the thermo-stability and high catalytic activity of the novel Triazole-Au(I) complexes recently developed in our group, the three component coupling reaction (AAA or 3A) between aldehyde-amine and alkyne will be investigated. As reported by Li and coworkers, terminal alkynes could be activated by Au to give imines when AuCl was used as the catalyst. However, only secondary aliphatic amines could be used when using the AuCl as a catalyst. Considering the higher-thermostability and more importantly, the presence of a more reactive cationic Au (I), we postulated that the Triazole-Au complexes could be effective catalysts for this transformation. Primary amines could be used when using the Triazole-Au complex as a catalyst. Initial results clearly indicate this, as the cascade condensation product was formed in good yield.

Phys Sci & Enq Poster 15:

STUDY OF REACTIONS USING 1,2,3-TRIAZOLES AS ORGANO MOLECULES

Masih Ahmed, Cheng Zhong, and Dr. Xiaodong Shi
Eugene C. Bennett Department of Chemistry, West Virginia University, WVNano Initiative

N-Heterocylic carbene chemistry is a well investigated and researched field. These organic structures have proven to be useful as ligands and catalysts. By deprotonating the 2-carbon, an excellent nucleophile is formed which serves as a catalyst for a multitude of reactions.

Our labs facilitation of triazole synthesis has created an opportunity to use these organic molecules in other chemical faculties. Due to its high electron density, the triazole will mimic the behavior of the NHC carbene molecules. The triazole will also serve as a stronger nucleophile, thus the goal is to show that the triazole molecule is a better catalyst for these reactions.

We have studied triazole catalysis on reactions between unsaturated and saturated aldehydes. The reactions have been carried out in sets of three; a control with no triazole, a reaction with triazole, and a reaction using a ylide reagent. Results have shown that presence of a triazole catalyst produces slightly higher yield. Further experimentation is being carried out under different conditions to see what the optimal conditions for catalysis are.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 16:

ELECTROCHEMICAL DETECTION OF COPPER, LEAD, AND MERCURY USING ANODIC STRIPPING VOLTAMMETRY

Jason Kang, Yueting Wu, and Dr. Nick Wu
Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506-6106

Abstract: Copper, lead, and mercury are highly toxic elements and are associated with many health problems. Thus, the development of a rapid, simple, and sensitive method for simultaneously monitoring copper and other toxic metals is desirable. In this study, square wave anodic stripping voltammetry (SWASV) was used for the detection of Cu(II), Pb(II), and Hg(II) on a modified indium tin oxide electrode. Nano-sized gold triangles were deposited on an indium tin oxide film coated glass via self-assembled polystyrene spheres and electron-beam lithography. Scanning electron microscopy images show the modified indium tin oxide electrode to be adequately arrayed and intact. The influence of the deposition potential and deposition time of copper on its peak stripping current was investigated and optimized. Under optimal conditions, the limit of detection was found to be favorable. This electrode system has a great potential for the direct determination of trace metals in the environment and biological samples.

Phys Sci & Eng Poster 17:

Conversion of BINOLs as Chiral Reagents to Homo-Bidentate Ligands

Maranda Poling, Sujata Sengupta, and Dr. Xiaodong Micheal Shi
C. Eugene Bennett Dept. of Chemistry, West Virginia University, Morgantown, WV 26505

The use of (S)-BINOL as a chiral reagent from asymmetric synthesis has been extensively investigated in the past. The design and synthesis of modified BINOLs as ligands in asymmetric catalysis continues to be an area of interest. By converting both of the hydroxyl groups of BINOL to two other functional groups capable of coordination with metals, discoveries of many useful C_2-symmetrical homo-bidentate ligands have been found. With the development of triazo and its excellent coordinating ability in metals, there is hope to make chiral triazo-based BINOL derivative liagnds for asymmetric catalysis. While many ligands have been tested with popular metals, the goal is to experiment ligands as catalysts with other metals. With the experimental results thus far, the proper BINOL derivative compounds have been successfully made and in large quantities. The next step is to prepare the ligands for experimentation and test their reactivity with less familiar metals, such as diethyl zinc.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 18:

Ionic Conductivity of Apatite-Type Solid Oxide Electrolytes in Pure Oxygen

Zachary P. Santer and Dr. Edward M. Sabolsky
Department of Mechanical and Aerospace Engineering
College of Engineering and Mineral Resources
West Virginia University
Morgantown, WV 26506-6070

There is a need for a solid oxide electrolyte material with greater ionic conductivity at lower temperatures than has been achieved to date with doped zirconia, the most common, and rather expensive, electrolyte material. Oxyapatite electrolytes have been shown to have a linear, one-direction ionic conduction path. This leads to high ionic conductivity, potentially at relatively low temperatures, which are necessary for efficiency. Four-point conductivity tests have been run. The test samples were wired to a power source and a multimeter. Pure oxygen was flowed around the samples inside of a tube furnace during the tests. The tests were run at temperatures at one-hundred degree intervals up to and including 800°C, with currents ranging from 0.01 to 0.09 amps. At this time, the tests have yet to be completed. Thus, no conclusions can be reached as to which dopings allow the highest ionic conductivity. We hope to find anoxyapatite with greater moderate-temperature ionic conductivity than doped zirconia.

Phys Sci & Eng Poster 19:

The Effects of Nanoscale Holes on Solar Cells

Vincent DeGeorge
Department of Physics, West Virginia University, Morgantown, WV 26505

Increasingly efficient solar to electrical energy conversion is of increasing interest and demand as a viable and sustainable means of renewable energy. The effects of nanoscale patterning at the metal-semiconductor interface of a schottky solar cell are investigated. Effects beyond those produced by variations in the active area of the cell due to the patterning are expected to be observed. N-type GaAs(100) substrates were used in the fabrication of the thin film solar cells. A selection of samples was made porous on the nanoscale using electrochemical etching. Forming the metal-semiconductor schottky barrier, Indium was deposited by thermal evaporation. On porous samples the evaporation was done at an angle to form intermittent discontinuities in the schottky barrier on the nanoscale. Both porous and nonporous schottky solar cells underwent current/voltage measurements under various lighting conditions in order to determine their photovoltaic characteristics. Results indicate photoresponse from both non-porous and porous In-GaAs schottky solar cells and significant effects of the nanoscale discontinuities in the schottky barrier due to the nanopores.

Physical Sciences and Engineering Category

Phys Sci & Enq Poster 20:

EFFECTS OF NANOSCALE GRATING ON PHOTOCHARACTERISTICS OF Al/n-GaAs SCHOTTKY SOLAR CELLS

Andrew Higgins and Vincent DeGeorge
Department of Physics, West Virginia University, Morgantown WV 26505

The conversion efficiency of modern GaAs photocells is paramount to their acceptance as a viable form of energy conversion over other conventional means. The characterization of a novel form of thin film metal-semiconductor solar cell contact geometry, which seeks to overcome the limits of solar radiation intensity by constructively interfering with specific wavelengths of visible light, is presented. SEM images show a well-developed grating designed to elicit interference for specific incident wavelengths. Current-Voltage measurements were carried out to determine the ideality and barrier height of the Al/n-GaAs (100) barrier as contacted with In. The forward bias characteristics of our samples have been fitted to, and agree well with, the widely accepted thermionic emission model beyond V>>3kT/q. Conversion efficiency was determined as a function of laser intensity and angle of incidence with varying grating spacing. It was determined that a constructive grating indeed increases the conversion efficiency in Al/n-GaAs Schottky diodes.

Nanosciences Category

Nanosci Index

Nanosciences Category

Poster 16: *Nano-Enzyme Systems: Development of an Artificial Liver for Modeling Protein Protein Interactions.* RaQuetta M. Howard,[1]* Jarod Kabulski,[2] Lance Wollenberg,[2] and Peter M. Gannett[2]

Poster 17: *Growth and Characterization of $BaCoF_4$ Multiferroic Single-Crystal Thin Films.* David Lederman, Felio Perez, Frank M. Davis, and Jacquelyn Queen

Poster 18: *Janus Particles: Fueling Autonomous Motion on the Nanoscale.* Zack Jones, Shengrong Ye, Dennis Jenkins, and Dr. Richard Lloyd Carroll

Poster 19: *Viscosity Measurements of Phospholipid DMPC-DHPC.* Makenzie Green, Tarra Hall, Xingwei Wu, Dr. Lisa Holland, and Dr. Mary Ann Clarke

Poster 20: *Viscosity characterization of phospholipids for developing a novel non-mechanical microvalve.* Tarra Hall, Makenzie Green, Xingwei Wu, and Lisa Holland

Poster 21: *Electrical characterization of Aluminum Nitride (AlN) Metal-Insulator-Metal (MIM) mesa structures.* Jonathan C. Thornton[2], Sarah Caprio[3], Sridhar Kuchibhatla[1], Richard Farrell[1], and Dimitris Korakakis[1, 4]

Nanosciences Category

Nanosci Poster 1:

Nanophotonics: Design, Fabrication, & Characterization of Photonic Crystals

Matthew S. Simmons, Bashar M. R. Hamza, and Dr. Jeremy M. Dawson
Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV 26506-6109

The purpose of this research is to design a silicon photonic crystal transducer for portable, highly sensitive, bio-sensors. In contribution to this research, I am working on fabricating a photonic crystal for operation at infra-red wavelengths (1310 nm). A nine step, detailed end-to-end process flow is developed as the experimental plan to provide research standards and reproducibility. Since most of this research is performed in cleanrooms, measures are taken to prevent contamination of samples because the features on such samples are on the micron scale in size and therefore are very susceptible to particle contamination. Successfully electron beam (e-beam) writing in positive e-beam resist on silicon has been accomplished, achieving 640 nm lattice holes in a 30x50 micron area. The next phase in this research will focus on developing an etch process for the photonic crystal so the pattern will be transferred into the underlying Si substrate.

Nanosci Poster 2:

PROTEIN ARRAYS ON FUNTIONALIZED GLASS SURFACES

Denzel Parks, Lenin Leon, and Parviz Famouri
Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV, USA

In order to begin the process of building biomolecular transport mechanisms based on biological motor proteins a strong foundation must be constructed. In order to bind a biomolecular structure to an inorganic material, biotin-streptavidin bonds combined with an Aminopropyltriethoxysilane (APTES) are necessary. The biotin vitamin and streptavidin protein have a naturally extremely high affinity ($10^{\wedge-15}$mol/L) to each other, causing them to be one the strongest bonds non-covalent in nature. APTES is the cross linking agent that couples the biotin-streptavidin bond to an inorganic surface. Using the APTES allows the biotin-streptavidin compound to be attached to the glass surface. The patterning process of the protein start when a photo derivative of biotin is exposed to UV (365 nm) using a photolithographic procedure the, photosensitive biotin is activated and cross-linked with the APTES. Once the foundation is complete, a biomolecular structure can be created. The molecular motors, actin and myosin, are to be the primary components of the structure. Molecular motors have the ability to create force and energy once bound with ATP. Biological motors are considered highly more efficient than man-made motors, being able to control molecular motors can lead to the capability to use this interaction to power nanodevices.

Nanosci Poster 3:

Surfactant Modification of Superparamagnetic Iron Oxide Nanoparticles

Aaron L. Routzahn and Dr. R. Lloyd Carroll
C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV

Superparamagnetic Iron Oxide Nanoparticles (SPIONs) are being explored for biomedical applications, including drug delivery, molecular targeting, magnetically-induced heating, and MRI contrast enhancement. All of these applications require the use of materials having accessible chemical handles with which to control molecular interactions between SPIONS, drugs, targeting molecules, and ultimately, the biological target. In this work, we will present results of SPION synthesis and modification to bear reactive ligands to which may be attached proteins and other molecules. We have replaced the stabilizing oleic acid surfactant surrounding the SPIONs with several different bi-functional molecules; in this work, we highlight exchange with bi-functional alkyl acid-thiol, acid-halogen, and acid-ester. The ester termination has been further transformed through hydrolysis to the carboxylic acid. These transformations have been examined by IR, TGA, and NMR techniques. We have characterized the structure and magnetic properties of the SPIONs throughout the process with XRD and SQUID magnetometry, providing an insightful glimpse into the molecular changes occurring at the SPION.

Nanosci Poster 4:

IN VITRO SELECTIONS FOR MOLECULAR RECOGNITION ELEMENT FOR MELAMINE AND QUANTUM DOTS

Amanda Wriston
West Virginia University PO Box 605, Morgantown,, WV 26506

Molecular recognition elements can be pieces of single-stranded DNA or a specific chain of amino acids. These molecular recognition elements are very useful to detect trace amounts of a certain target. Melamine is a toxic, nitrogen-rich compound that has been used to dope pet and baby foods, which can lead to death. To find this MRE a pool of single-stranded DNA is selected against the target. Preliminary work thus far, including PCR and gel electrophoresis, has been done on the pool of ssDNA to be used in the selections.

Molecular recognition elements can also be in the form of peptides. Peptides are grown on the surface of yeast cells and are then selected against quantum dots. Quantum dots are a valuable tool to look at protein-protein interactions, tag proteins, and protein localization. MRE's tag quantum dots so that these properties are easily tracked.

Nanosci Poster 5:

In Vitro Selection of Molecular Recognition Elements for 2, 4 D Acid and Quantum Dots for use in Biosensors

Briana G. Wallace and Dr. Letha J. Sooter
West Virginia University, P. O. Box 6057Morgantown, WV 26506-6045

Both the detection and binding of low levels of pesticide and the binding and use of quantum dots as detection agents have many possible advances. Finding a single-stranded DNA molecular recognition element for 2, 4, Dichlorophenoxyacetic Acid allows trace levels to be detected in the environment; this enables correlations between diseases such as cancer, birth defects and brain disease and the presence of this specific pesticide. Finding a peptide molecular recognition element for quantum dots allows their use as a fluorescent marker for proteins. These selections involve the use of a random ssDNA (10^{13} different molecules) or peptide (10^{7} different molecules) pool. A new DNA pool is currently in development to begin a new selection against the pesticide. After selection is complete and a specific sequence is identified it can then be incorporated into a molecule specific biosensor. Flow cytometry shows some binding of quantum dots to peptides but more rounds of selection need to occur to confirm peptide binding.

Nanosci Poster 6:

Creating Cadmium Sulfide Microtubes for a Molecular Sensor

Rachel Wallner and Dr. R. Lloyd Carroll
C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV 26506-6045

Cadmium sulfide is an important semiconductor with potential applications as molecular sensors. In this project, H_2S (g) and $CdSO_4$ (aq) were reacted in the pores of a polycarbonate track-etched membrane to produce cadmium sulfide microtubes and microrods in the pores. The growth process was optimized with respect to various cadmium sulfate concentrations and several pore sizes of the polycarbonate membrane to determine the best possible combination to grow the most uniform and durable microtubes. The microtubes and microrods were extensively characterized by scanning electron microscope. SEM images suggest that a three to five molarity of cadmium sulfate and a 0.8 micron pore size of the polycarbonate membrane may produce consistent cadmium sulfide tubes. Cadmium sulfide crystals grown on polydimethylsiloxane (PDMS) were analyzed by X-ray diffraction and X-ray photoelectron spectroscopy. Preliminary tests show that the polycarbonate track-etched membrane can handle metal deposition by means of E-beam evaporation.

Nanosci Poster 7:

How Can Interest in Nanotechnology and Nanosciences be Targeted Towards Young Adults?

Kara L. George, Toni Zito, Michelle Richards-Babb, and Eric Kincaid
C. Eugene Bennett Department of Chemistry
West Virginia University
Morgantown, WV 26506

Can interest in a job field begin as early as middle school? Would it be too early to begin an outreach for children as young as elementary school? These questions were the backbone of my research by choosing to incorporate Nanotechnology into the curriculum the students were introduced to the fastest up and coming field in the science discipline. In the 4-H Camp at Jackson's Mill that I presented, the goal was to reach young adults ranging from 12 to 21 years of age. This large age gap was essential to the research because it makes the data collected interesting to correlate older versus younger age groups. The research approach began when I assisted in a science camp where my group was given a full day to present the information that I would use at Jackson's Mill. The results, thus far, show that kids interested in sciences showed an increased appeal to Nanotechnology and Nanosciences. My hope is that my outreach will interest the kids to want to focus their studies on this science and in particular nanoscience.

Nanosci Poster 8:

Photonic Crystal Waveguide Fabrication

Jared A. Crawford, Jeremy M. Dawson, and Bashar M. R. Hamza
Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV 26506-6109

Photonic crystals are comprised of a nano-scale lattice of holes or pillars that produce a unique bandgap when exposed to an external light source. The optical bandgap exhibited by a photonic crystal is analogous to the electrical bandgap exploited in modern electrical semiconductors. Unlike semiconductors, which regulate current based on an applied voltage, photonic crystals regulate light permittivity based on wavelength. To function properly, these crystals must exist inside a structure that only permits photon entry and emission from distinct locations. One such structure that can be used to accomplish this is an optical waveguide. Waveguide fabrication process must be carefully performed to ensure anisotropy of the sidewalls, maintaining total internal reflection of the photons within the waveguide structure. This summer, my goal was to fabricate waveguide structures containing photonic crystals, enabling optical characterization of bandgaps at infrared wavelengths. Fabrication processes involve a combination of sputtering, photolithography, inductively coupled plasma etching, reactive ion etching, and other common micro/nanofabrication techniques to produce both the waveguide structure and an photonic crystal.

Nanosciences Category

Nanosci Poster 9:

FABRICATION AND ELECTRICAL CHARACTERIZATION OF ALUMINUM NITRIDE (ALN) METAL-INSULATOR-METAL (MIM) MESA STRUCTURES

Sarah Caprio[3], Jonathan Thornton[2], Sridhar Kuchibhatla[1], Richard Farrell[1], and Dimitris Korakakis[1, 4]

1. Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV, USA.

2. Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV, USA.

3. Department of Chemical Engineering, West Virginia University, Morgantown, WV, USA.

4. National Energy Technology Laboratory, West Virginia University, Morgantown, WV, USA.

Aluminum Nitride (AlN) thin film based metal-insulator-metal (MIM) devices are being investigated currently for applications such as biosensing /biophysical detection , RF-Micro electromechanical system (MEM) switches for reducing the pull down voltage due to its spontaneous polarization, ability to be deposited at low temperatures, and patterned using conventional lithography [1,2]. In addition, the implementation of MIM structures ensures that the electrical properties are dominated by the AlN films, and hence can be determined directly by using electrical characterization techniques such as capacitance voltage (C-V) and current voltage (I-V) measurements.

For MIM structures in an electrical configuration with the top electrode area less than the bottom electrode, non-normal components of the electric field (i.e. fringing effects through the AlN film) can influence the device's electrical properties and response. This work investigates the piezoelectric and electrical characteristics of AlN MIM circular mesa structures, fabricated by selectively etching the AlN film around the top electrode. This configuration also allows for better confinement of the electric field, and therefore more accurate piezoelectric measurements. The effect of mesa diameter on the stored charge and the subsequently measured piezoelectric coefficient will also be addressed. C-V and laser doppler vibrometry measurements of the AlN mesas will be presented.

1. G.J.Papaioannou, T.Lisec, European Microwave Integrated Circuits Conference, p 540-3, (2007).
2. Keng-Liang Ou,Chang-Chih Chen; Che-Tong Lin; Sheng-Yang Lee; Ling-Hung Lin; Chiung-Fang Huang , Appl.Surf.Sci, 253, n 11, p 5173-8 (2007).

Nanosci Poster 10:

SIGNATURES OF CHAOS IN THE DYNAMICS OF TRAVELING-WAVE ELECTROPHORESIS

Austin A. Anuta-Darling
Department of Physics, West Virginia University
Morgantown, WV 26505-6045

This research investigates the dynamical system associated with a model of traveling-wave electrophoresis. Traveling-wave electrophoresis is designed for selective separation of ions in fluidic channels and utilizes oscillating electric fields to trap and mobilize them. A two-dimensional model of traveling-wave electrophoresis is used along with a trigonometric equation for the electric potential within the channel. Under certain conditions the path taken by an ion in the channel under the influence of the oscillating electric field can become chaotic. This research focuses on investigating such chaos. The growth, decay and intermittency of the chaotic dynamics which develop in this model are studied using a number of mathematical tools. Tools of primary use are Lyapunov exponents, correlation dimensions, and amplitude spectrums from Fourier analysis. These tools are used in conjunction to provide a detailed view of how this chaos evolves. The amplitude spectrums in particular reveal an underlying relationship between chaotic noise and average ion velocity.

Nanosci Poster 11:

SURFACE PLASMON RESONANCE IN SUBWAVELENGTH NANOSTRUCTURES FOR ENHANCEMENT OF SENSING PROCESSES

Scott Cushing and Dr. Nick Wu
Department of Mechanical and Aerospace Engineering
West Virginia University, Morgantown, WV

Surface plasmons are the collective oscillations of electrons excited by electromagnetic waves at a metal dielectric interface. The electromagnetic field created by these oscillations can be localized to sub wavelength nanostructures, where the excitation wavelength depends on the physical dimensions of the structure. This local field interacts with surface adsorbates and can thus be used in both sensing and surface enhancement processes. This research wishes to test several different geometries- triangles, squares, dimers- to determine which structure can provide the greatest sensitivity and enhancement. The structures are created by electron beam lithography and nanosphere lithography, then tested by a combination of transmission and reflection spectroscopy. Before creation, computer simulation techniques are utilized to estimate the local field strength and wavelength of excitation. In order to see the different sensing and enhancement merits, the structures are varied in a systematic method. This information will then be used in two main areas: the creation of sensors with the capability of picomolar or better detection and the further enhancement of raman and fluorescence processes.

Nanosci Poster 12:

Self-Humidifying Polymer Electrolyte Membranes Through Nanomaterial Incorporation

Charles Tarisai Ndhlovu, and Dr. Edward M. Sabolsky
West Virginia University, MAE Dept
Energy Materials Program, PO Box 6106
Morgantown, WV 26506-6106

Nafion® is a polymer electrolyte material that is typically used within proton exchange membrane fuel cells (PEMFCs). The performance of PEMFCs is shown to increase with temperature until a temperature of ~100°C where the membrane begins to dehydrate. This loss of water from the Nafion® matrix causes excessive decay of the proton conductivity. In this study, we will show that the incorporation of dispersed inorganic nanomaterials, such as zirconia (ZrO_2), magnesium oxide (MgO) and zirconia hydroxide ($Zr(OH)_4$), into the Nafion® matrix will improve the thermal stability and water retention of the electrolyte. In order to insert these nanoparticles into the Nafion®, two separate solution/precipitation processes will be utilized. The first process involves a direct sol-gel technique where dilute alkoxide solutions (like zirconium-isopropoxide) are adsorbed within the membrane structure and later precipitated within the pore structure leaving metal-hydroxide nanoparticles. The second process utilizes the same sol-gel technique coupled to a hydrothermal process in order to crystallize the metal-hydroxides to the oxide form using high pressure at relatively low temperature. The incorporation of these high surface area inorganic nanoparticles within the membrane provides adsorption sites for water and hydroxyl ions. These sites allow for water retention at higher temperatures and lower relative humidities, resulting in an increase in proton conductivity and thermo-mechanical properties. The efficiency of the Nafion® should improve up to the temperatures of 120-150˚C. This temperature range is favored by emerging technology markets like that of powering emission-free hydrogen vehicles.

Nanosci Poster 13: (Only judge poster, presenter absent)

PLGA NANOPARTICLES CONTAINING GENTAMYCIN FOR THE ELMINATION OF INTRACELLULAR *STAPHYLOCOCCUS AUREUS*

Stephanie Knittle, Steven Regal, Hongshuai Li, and Bingyun Li
Department of Orthopedics, School of Medicine, West Virginia University

Osteomyelitis is a bone infection that occurs frequently during the implantation of orthopedic devices, and can lead to additional surgeries and possible amputation. This can be a chronic condition and is most commonly caused by a bacterial pathogen, *Staphylococcus aureus.* The reoccurrence of osteomyelitis may be due to *S. aureus* that can invade osteoblast cells intracellularly. The goal of this study is to determine if nanoparticles containing an antibiotic, gentamycin, can enter osteoblast cells and eliminate the intracellular bacteria *S. aureus*. The PLGA nanoparticles were created using an emulsion and evaporation method. The *S. aureus*, human osteoblast cells, and nanoparticles were co-cultured. Flow cytometry and confocal microscopy were used to verify the entry of nanoparticles intracellularly. The number of intracellular bacteria were quantified by lysing the osteoblast cells and analyzing the results by colony counting. When containing gentamycin, nanoparticles had shown the ability to eliminate intracellular *S. aureus* in human osteoblast cells. This nanoparticle delivery system could possibly provide a new treatment option for osteomyelitis.

Nanosci Poster 14:

FABRICATION OF GRAPHENE BASED SENSOR PLATFORMS FOR BIOSENSORS

Molly Nagowski, Charter Stinespring, Srikanth Raghavan, Timothy Nelson, and Tobias Denig
Department of Chemical Engineering, West Virginia University, Morgantown, WV.

The development of novel graphene-based chemo biosensors is achieved by the necessity of reliable sensor platforms and the use of exfoliated graphene. In this effort, we have adapted the approach of Geim and co-workers. Square mesas are plasma etched into highly ordered pyrolytic graphite using oxygen-based inductively coupled reactive ion etching. The mesa structure is next pressed into a thin layer of photo resist and baked so that the mesas are firmly attached to the SiO2/Si substrate, and the graphene is exfoliated till few-layers or single-layer. These are released using a solvent and some of the graphene flakes are then transferred to a device substrate by dipping the substrate into the solvent. The substrate itself is a 300 nm thick SiO2 layer on Si prepared by the plasma assisted chemical vapor deposition. The thickness of the oxide is critical since it allows the thinnest graphene flakes identified using optical microscopy. Future research includes e-beam lithography methods for placing source and drain contacts on the optically identified few-layer-graphene flakes will be developed. This will then serve as the basic sensor platform for various types of biosensors.

A.K. Geim and K.S. Novoslov, The Rise of Graphene, Nature Materials 6 (2007) 183.

Nanosci Poster 15:

In vitro selection of atrazine herbicide and quantum dots via molecular recognition elements

Brandi N. Findley and Letha J. Sooter
Department of Biology, West Virginia University, PO Box 6057 Morgantown, WV 26506-6057

Research currently being conducted in Dr. Letha Sooter's laboratory is performed to detect harmful pesticides and to tag proteins for medical utilization. It is by *in vitro* selection that this research is possible. In selection, a library of 10^7 -10^{13} molecules is used to isolate molecules that bind specific targets. These molecules are molecular recognition elements (MREs). The bound molecules are amplified and passed through another round of selection with the target.

Through repeated rounds of *in vitro* selection, the library can be reduced to 5 molecules that bind the target. Approximately two different components may comprise a library of molecules: single stranded DNA or peptides.

The targets being bound by MREs are the herbicide atrazine and quantum dots. Atrazine is used commercially to inhibit the emergence of weeds. Scientists are interested in detection of trace amounts of this herbicide in the human body to determine if small amounts have health effects. Quantum dots are used to tag proteins in cells. Quantum dots fluoresce inside cells, and the protein interactions and localizations can be detected.

Nanosci Poster 16:

Nano-Enzyme Systems: Development of an Artificial Liver for Modeling Protein-Protein Interactions

RaQuetta M. Howard,[1]* Jarod Kabulski,[2] Lance Wollenberg,[2] and Peter M. Gannett[2]
[1]Alabama A&M University; [2]West Virginia University, Pharmaceutical and Pharmacological Sciences,
**WVNano Initiative Research Experience for Undergraduates*

Cytochrome P450 enzymes are important for drug metabolism, accounting for 75% metabolism of drugs and are the major enzyme in first pass drug metabolism. Studies have shown that these enzymes are susceptible to protein-protein interactions and this can affect drug metabolism. In this research, an inexpensive and more efficient technique is being studied to immobilize two different P450 enzymes, creating a platform to study protein-protein interactions. In previous studies, drug metabolism has been observed after immobilizing P450 enzymes to a gold surface via a self-assembled monolayer (SAM). A new method of treating the Au-SAM chips with carboxlyesterase, an enzyme that converts esters to carboxylic acids, will allow the attachment of additional enzymes. The goal of this research is to prepare 16-mercaptohexadecanoate chips (Au-MHD), treat with carboxylesterase to convert SAM esters to carboxylic acids, activate the carboxylic acids with N-(3-dimethylaminopropyl)-N'-*ethylcarbo*-diimide (EDC) and N-hydroxysulfosuccinimide (NHS), and attach CYP2C9 via amide bond formation with the SAM. Enzymatic activity is determined by monitoring the conversion of diclofenac to 4'-OH diclofenac using HPLC and UV detection.

Nanosci Poster 17:

Growth and Characterization of $BaCoF_4$ Multiferroic Single-Crystal Thin Films

David Lederman, Felio Perez, Frank M. Davis, and Jacquelyn Queen
Department of Physics, West Virginia University, Morgantown, WV 26506-6045

Multiferroic materials are materials that exhibit coupled electrical and magnetic properties. Barium Cobalt Fluoride ($BaCoF_4$) is known to be one such material. Based on the existing literature, single-crystals of $BaCoF_4$ have previously been created and investigated, but the thin film has yet to be made. By carefully choosing a substrate that will allow single-crystal growth of $BaCoF_4$, and then growing the thin film via molecular beam epitaxy, it is hoped that a thin film of $BaCoF_4$ will result. We have selected a substrate made of Strontium Titanate (STO) because its lattice parameters are very close to those of palladium, which will be sputtered on top of the STO as a buffer layer. We will then load the substrate into an MBE machine equipped with beams of Barium Fluoride (BaF_2) and Cobalt Fluoride (CoF_2), and then deposit the two materials at equal rates to make a single- crystal thin film of $BaCoF_4$. The crystal structure of the thin film will then be characterized by X-ray diffraction, and its properties will be measured by techniques such as atomic force microscopy, magnetoresistance measurement, and capacitance measurement.

Nanosci Poster 18:

Janus Particles: Fueling Autonomous Motion on the Nanoscale

Zack Jones, Shengrong Ye, Dennis Jenkins, and Dr. Richard Lloyd Carroll
C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV 26506

Janus particles, 200 nm – 8 μm SiO_2 beads with a half coating of a catalytic metal, show directed propulsion when placed in a chemical fuel. All particles of this size exhibit a random walk known as Brownian motion, but Platinum coated Janus particles in H_2O_2 solution have been shown to move at much higher speeds due to the catalytic decomposition of the H_2O_2 on the Platinum[1]. It is of high interest to find other chemical fuels that can propel these particles autonomously through solution. In conjunction with the Platinum/ H_2O_2 system, new systems of Platinum/Hydrazine and Platinum/Benzoyl Peroxide were studied by computerized tracking of the particles in each solution to analyze the particle's speed and MSD vs. time interval. Results showed that the Platinum/ H_2O_2 system exhibited autonomous motion, whereas the other systems showed no evidence of directed propulsion; the slope of the graph of MSD vs. time for the Hydrazine and Benzoyl Peroxide at various concentrations were not significantly greater than the diffusion coefficient, D, proving the motion was Brownian in nature.

[1] J. R. Howse, Physical Review Letters 99, 48102 (2007)

Nanosci Poster 19:

VISCOSITY MEASUREMENTS OF PHOSPHOLIPID DMPC-DHPC

Makenzie Green, Tarra Hall, Xingwei Wu, Dr. Lisa Holland, and Dr. Mary Ann Clarke
C. Eugene Bennett Department of Chemistry
West Virginia University, Morgantown, WV 26506

Analyses involving lab-on-a-chip devices offer quick, inexpensive alternatives to analyses performed on traditional lab equipment, and phospholipids are smart additives for chemical separations with unusual physiochemical properties. The purpose of this research is to determine the viscosity of phospholipid DMPC-DHPC preparations at various temperatures and pressures so that their viscosity changes can be utilized in lab-on-a-chip devices to control non-mechanical microvalves. It is known that phospholipid is a non-Newtonian fluid, so the empirical power law can be used to calculate the effective viscosity of the phospholipid. Using a custom-built pressure system, the phospholipid is pushed through a capillary to a UV detector, which is used to measure the elution time. The elution time is then utilized to calculate the velocity of the phospholipid as it flows through the capillary. Finally, the velocity, pressure, and capillary dimensions are manipulated to determine the effective viscosity using the empirical power law. At this time, it has been determined that the viscosity of the phospholipid decreases as the pressure increases, indicating that the phospholipid behaves as a pseudoplastic.

Nanosci Poster 20:

Viscosity characterization of phospholipids for developing a novel non-mechanical microvalve

Tarra Hall, Makenzie Green, Xingwei Wu, and Lisa Holland
Holland Lab, WVNano Sure, National Science Foundation

Lab on a chip is a technology that uses micro fluidic technology to perform the same actions as large lab equipment on a small chip. The goal of this technology is to make a cheap disposable way to perform tasks that at this time cost an extremely large amount of money. The problem with this technology is that there is no way to direct fluids on a chip without using some type of mechanical device, which keeps it from being cheap and disposable. Phospholipids are non-Newtonian fluids that may be able to help with this issue. The viscosity of phospholipid under different conditions has yet to be evaluated. To determine this, special instrumentation was designed and tested. The new approach measures the velocity of a plug of material through 80 cm capillary with an inner diameter of 10^{-4} meters. The capillary is monitored with a modified UV visible absorbance detector. Once the velocity is measured it is easy to calculate the viscosity. The viscosity was measured under different conditions.

Nanosci Poster 21:

Electrical characterization of Aluminum Nitride (AlN) Metal-Insulator-Metal (MIM) mesa structures

Jonathan C. Thornton[2], Sarah Caprio[3], Sridhar Kuchibhatla[1], Richard Farrell[1], and Dimitris Korakakis[1, 4]

1. *Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV, USA.*
2. *Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV, USA.*
3. *Deparment of Chemical Engineering, West Virginia University, Morgantown, WV, USA.*
4. *National Energy Technology Laboratory, West Virginia University, Morgantown, WV, USA.*

AlN thin films based metal-insulator-metal devices are being investigated currently for applications such as biosensing /biophysical detection , RF-Micro electromechanical system (MEMS) switches for reducing the pull down voltage due to its spontaneous polarization, ability to be deposited at low temperatures and patterned using conventional lithography [1,2]. Also, the implementation of metal-insulator-metal (MIM) structures ensures that the electrical properties are dominated by the AlN films and hence can be determined directly by electrical characterization techniques such as capacitance voltage (C-V) and current voltage (I-V) measurements. For MIM structures in an electrical configuration with the top electrode area less than the bottom electrode, non-normal components of the electric field i.e. fringing effects through the AlN film can influence the device's electrical properties and response. This work investigates the piezoelectric and electrical characteristics of AlN MIM circular mesa structures, fabricated by selectively etching the AlN film around the top electrode. This configuration also allows for better confinement of the electric field, and therefore more accurate piezoelectric measurements. The effect of mesa diameter on the stored charge and the subsequently measured piezoelectric coefficient will also be addressed. CV and laser doppler vibrometry measurments of the AlN mesas will be presented.

1. G.J.Papaioannou, T.Lisec, European Microwave Integrated Circuits Conference, p 540-3, (2007).

2. Keng-Liang Ou,Chang-Chih Chen; Che-Tong Lin; Sheng-Yang Lee; Ling-Hung Lin; Chiung-Fang Huang , Appl.Surf.Sci, 253, n 11, p 5173-8 (2007).