2012

2012 Symposium Brochure

STEM SURE/IRES, WVNANO REU, WVU HONORS SURE, BIOLOGY REU, SURI

Summer Undergraduate Research Symposium

Thursday, July 26, 2012
Erickson Alumni Center
West Virginia University
Morgantown, WV

wvnano.wvu.edu/reu - http://biology.wvu.edu/nsf-reu
www.honors.wvu.edu/sure or STEMSURE - www.hsc.wvu.edu/wvucn

Building the Future of West Virginia, One Idea at a Time

Summer Undergraduate Research Symposium 2012
West Virginia University

Thursday July 26, 2012
Erickson Alumni Center, Ruby Grand Hall
West Virginia University
Morgantown, WV

I. Schedule of Events

9:00-9:30 AM	Poster Setup ─*Undergraduate participants arrive, register, and put up posters. Participants must leave Erickson Alumni Center by 9:30 AM and should return at 11:00 AM.*
9:30-11:00 AM	Poster judging ─ *No participants present and not open to public.*
11:00-11:45 AM	Welcome and Key Note Speaker ─ *All welcome: parents, research advisors, graduate students, undergraduate participants, and general public.*

- *Welcome: Dr. Michelle Richards-Babb, Associate Prof., Chemistry*
- *Introductory Remarks: Dr. Keith Garbutt, Dean of the Honors College*
- *Key Note Speaker: Dr. Michele G. Wheatly, Provost, WVU*

11:45 AM-12:30 PM	Lunch ─ *Judges and poster presenters first priority.*
12:30 PM-2:30 PM	Poster Presentations ─ *Open to all and concurrent with final judging of posters. Poster judging will continue with judges assessing participant's ability to answer questions related to his/her research.* ***Judges have preference!***
2:30-3:00 PM	Awards Ceremony and Closing Remarks
3:00 PM	Poster Take-Down ─ *Any posters remaining after 3:30 PM will be removed by the staff.*
3:05 PM	*Post-questionnaires (WVNano REU & STEM SURE participants)*

II. Poster Judges

Judge	Affiliation	Category Judging
Shuo Wei	Biology, WVU	*Biological & Health Sciences*
Lisa Salati	Biochemistry, WVU	*Biological & Health Sciences*
Lance Lin	Civil & Environmental Eng., WVU	*Agricultural & Environmental Sci.*
Janet Tou	Human Nut. & Foods, WVU	*Agricultural & Environmental Sci.*
Amy Keesee	Dept. of Physics, WVU	*Physical Sciences & Engineering*
Jessica Hoover	Dept. of Chemistry, WVU	*Physical Sciences & Engineering*
Jeremy Dawson	CS & EE, WVU	*Nanosciences*
Weiqiang Ding	WVU Shared Research Facilities	*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: Michelle Richards-Babb; co-PI: David Lederman)

Participant	Poster	Major	Home School	Faculty Advisor
Laura Carpenter	Phys Sci & Eng #2	Physics/Math	Marietta College	Xueyan Song, ME & AE
Robert Chastain	Phys Sci & Eng #11	Appl. Math.	C. of Coastal GA	David Lederman, Physics
Ann Jackson	Nanosci #6	Biology	WV Wesleyan C.	Letha Sooter, Pharmacy
Lawrence Jacob	Nanosci #18	Appl. Physics/EE	Morehouse College	Daneesh Simien, ME & AE
Matthew Logan	Phys Sci & Eng #12	Chemistry	Wheeling Jesuit U.	Yuxin Liu, CS & EE
Cody Mitchell	Ag & Env Sci #17	Chemistry	Washington & Jefferson	Lisa Holland, Chemistry
Olivia Pavlic	Phys Sci & Eng #17	Physics/Math	Bethany College	Alan Bristow, Physics
Joseph Reynolds	Phys Sci & Eng #14	Chemistry	Georgia Tech	Mikel Holcomb, Physics
Allison Rice	Nanosci #15	Chemistry	Westminster C.	Nick Wu, ME & AE
Katie Spears	Nanosci #2	Biochemistry	Maryville College	Tim Nurkiewicz, Physiology & Pharmacol.
Wesley Tish	Nanosci #11	Biomedical Eng.	Illinois Tech	Peter Gannett, Pharmacy

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

Participant	Poster	Major	Home School	Faculty Advisor
Vincent Brazelton, Jr.	Ag & Env Sci #9	Environ. Science	Tuskegee U.	Nicole Waterland, Horticulture
Tanya Dilan	Ag & Env Sci #8	Industr. Microbiol.	U. of Puerto Rico, Mayaguez	Daniel Panaccione, Mycology & Genetics
Haley Dugan	Ag & Env Sci #2	Molecular Biology	Kenyon College	Nicole Waterland, Horticulture
Joseph Hilgenberg	Ag & Env Sci #11	Biology	Muskingum U.	William Peterjohn, Biology
Jonah Joffe	Ag & Env Sci #10	Biology	Oberlin College	Jennifer Hawkins, Biology
Anna Koebley	Ag & Env Sci #1	Environ. Science	Allegheny College	Jamison Conley, Geography
Cameron Lewis	Ag & Env Sci #6	Genetics & Biotechnology	West Virginia State	Vagner Benedito, Biochemical Genetics
Justin Mathias	Ag & Env Sci #3	Biology	West Virginia U.	Richard Thomas, Biology
Matthew Mayher	Ag & Env Sci #5	Environ. Science	John Carroll U.	Brenden McNeil, Geography
Joseph Tilghman	Ag & Env Sci #7	Biology	Washington & Lee	Stephen DiFazio, Biology
Jennie Zhu	Ag & Env Sci #14	Anthropology, Geogr. & History	U. of Minnesota	Amy Hessl, Geography

C. STEM Summer Undergraduate Research Experiences (SURE) Site (Coordinator/Director: Michelle Richards-Babb; Assistant to Director: Corey Nida)

Participant	Poster	Major	Home School	Faculty Advisor
Joeseph Bright	Nanosci #13	Mech. Eng.	West Virginia U.	Nick Wu, ME & AE
Nicholas Burock	Bio & Health Sci #2	Chemistry	West Virginia U.	Brian Popp, Chemistry
Laura Casto	Nanosci #14	Math & Chem	WV Wesleyan C.	Lisa Holland, Chemistry
Loren Clevenger	Bio & Health Sci #9	Biochemistry	West Virginia U.	Kim Barnes, Biochemistry
Emily Eddy	Ag & Env Sci #16	Anthropology	West Virginia U.	Bradley Wilson, Geography
Marriah Ellington	Phys Sci & Eng #3	Chemistry	West Virginia U.	Suzanne Bell, Chemistry
Joseph Feeney	Nanosci #12	AE & ME	West Virginia U.	Daneesh Simien, AE & ME
Terri Griffith	Nanosci #4	Biology	West Virginia U.	Peter Gannett, Pharmacy
Cyrus Hajiran	Nanosci #3	Biology	West Virginia U.	Letha Sooter, Pharmacy
James Jirak	Phys Sci & Eng #9	Chemistry & German	West Virginia U.	Michael Shi, Chemistry
Mohamad Kassar	Nanosci #20	Elect. & Comp. Eng.	West Virginia U.	Marjorie Darrah, Mathematics
Chelsey Kirby	Phys Sci & Eng #6	Chemistry	West Virginia U.	Fabien Goulay, Chemistry
Kayla Lantz	Bio & Health Sci #5	Chemistry	West Virginia U.	Rajesh Naz, Obstetrics & Gynecology
Surya Manivannan	Nanosci #21	Chem. Eng.	West Virginia U.	Cerasela Dinu, Chem. Eng.
Michael Martin	Phys Sci & Eng #10	Comp. Eng.	West Virginia U.	Yuxin Liu, CS & EE
Anna McClung	Phys Sci & Eng #18	Chem. Eng.	West Virginia U.	John Zondlo, Chem. Eng.
Steven McHenry	Nanosci #8	Biology	West Virginia U.	Bingyun Li, Orthopedics
Joshua Morgan	Phys Sci & Eng #8	Chem. Eng.	West Virginia U.	Yong Yang, Chem. Eng.
Miranda Straub	Phys Sci & Eng #16	AE & ME	West Virginia U.	John Kuhlman, ME & AE
Craig Tenney	Phys Sci & Eng #21	Physics & Comp. Sci.	West Virginia U.	James Lewis, Physics

D. STEM SURE Participants Supported by Faculty Research Advisors (Justin Legleiter and Han-Ting Zhang)

Participant	Poster	Major	Home School	Faculty Advisor
Sherry Finkel	Nanosci #5	Secondary Sci. Educ.	West Virginia U.	Justin Legleiter, Chemistry
Arpun Prabhu	Nanosci #7	Chemistry	U. of Pittsburgh	Han-Ting Zhang, Behav. Med. & Psychiatry

E. International Research Experience for Students at Jilin University in China (PI: Michael Shi - CAREER Award funding for travel and partial funding through STEM SURE)

Participant	Poster	Major	Home School	Faculty Advisor
Deanna Boyer	Nanosci #10	Chem. Eng.	West Virginia U.	Michael Shi, Chemistry
Lucas Bracero	Phys Sci & Eng #4	Chemistry	West Virginia U.	Michael Shi, Chemistry
Matthew Brooks	Phys Sci & Eng #5	Biochemistry	West Virginia U.	Michael Shi, Chemistry
Justin Harvey	Nanosci #9	Biology	West Virginia U.	Michael Shi, Chemistry
Kailey Imlay	Nanosci #1	Biology	West Virginia U.	Michael Shi, Chemistry

F. WVU Honors Summer Undergraduate Research Experiences (SURE) Site (PI: Keith Garbutt; SURE Teaching Assistant: Robin Caulkins)

Participant	Poster	Major	Home School	Faculty Advisor
Jenna Brandt	Bio & Health Sci #8	Biology	West Virginia U.	Kevin Daly, Biology
Brett Clark	Bio & Health Sci #7	Biology	West Virginia U.	Rita Rio, Biology
Adam Collins	Phys Sci & Eng #13	Physics & Phil.	West Virginia U.	Duncan Lorimer, Physics
Rachel DeRoos	Bio & Health Sci #6	Psychology	West Virginia U.	Cheryl McNeil, Psychology
Danielle Empson	Ag & Env Sci #21	Ag. Biochem.	West Virginia U.	Kim Barnes, Biochemistty
Scott Ferris	Phys Sci & Eng #19	Physics	West Virginia U.	Richard Treat, Physics
Jakob Goldner	Ag & Env Sci #12	Wildlife & Fisheries	West Virginia U.	Todd Petty, Wildlife & Fisheries
Heather Griffith	Ag & Env Sci #4	Horticulture	West Virginia U.	Sven Verlinden, Horticulture
Amanda Hanrahan	Bio & Health Sci #1	Pschology, Forensic & Inv.	West Virginia U.	Aaron Metzger, Psychology
Alicia Harmon	Nanosci #19	Comp. Eng. & Biometr. Sys.	West Virginia U.	Jeremy Dawson, CS & EE
Tyler Holliday	Phys Sci & Eng #1	Biology & Biochem.	West Virginia U.	Robin Hissam, Chem. Eng.
Mason McMonegal	Ag & Env Sci #13	Agronomy	West Virginia U.	Eugenia Pena-Yewtukhiw, Soil Science
Jason Miles	Nanosci #17	Chem. Eng.	West Virginia U.	Charter Stinespring, Chem. Eng.
Matthew Miller	Ag & Env Sci #19	Animal & Nutr. Sci.	West Virginia U.	Janet Tou, Human Nut. & Foods
Kartik Motwani	Bio & Health Sci #10	Biology & Chemistry	West Virginia U.	Jim Belanger, Biology
Christopher Oldaker	Ag & Env Sci #18	Biochemistry	West Virginia U.	Janet Tou, Human Nut. & Foods
Maria Panaccione	Phys Sci & Eng #15	Geography & Int. Studies	West Virginia U.	Amy Hessl, Geography
Harshraj Parikshak	Bio & Health Sci #3	Biology	West Virginia U.	Jim Belanger, Biology
Sarah Robinson	Bio & Health Sci #4	Biology & Psychol.	West Virginia U.	Daniel Panaccione, Mycology & Genetics
Logan Shamberger	Nanosci #16	Physics	West Virginia U.	James Lewis, Physics
Stephen Sutton	Bio & Health Sci #11	Biology	West Virginia U.	Kevin Daly, Biology
Nathan Tehrani	Phys Sci & Eng #7	Physics & Biology	West Virginia U.	Maura McLaughlin, Physics
Kathryn Trupo	Ag & Env Sci #15	Forest Res. Manag.	West Virginia U.	William McDonald, Forest Pathology
Joshua Usilton	Phys Sci & Eng #20	Pre-Inv. & Forensic Sci.	West Virginia U.	Suzanne Bell, Chemistry

G. Summer Undergraduate Research Internships (SURI) (Director: George A. Spirou; Coordinator: Erica Stewart)

Participant	Poster	Major	Home School	Faculty Advisor
Bennett Alterman	Bio & Health Sci #13	Biology	Georgia Tech	Albert Berrebi, Otolaryngology
Alexandra Badia		Biochemistry	Chatham University	Stanislaw Majewski, Radiology
Brian Chen	Bio & Health Sci #14	Chemistry	Princeton U.	George Spirou, Otolaryngology
Joseph Franzen		Psychology	Denison U.	Han-Ting Zhang, Behav. Med. & Psychiatry
Michelle Holcomb	Bio & Health Sci #16	Biology & Psych.	Allegheny College	Julie Brefczynski-Lewis, Radiology
Jane Ivakhnitskaia	Bio & Health Sci #18	Biological Sci.	Cornell U.	Sergiy Yakovenko, Human Performance
Khoa Le Nguyen	Bio & Health Sci #12	Psychology	College of Wooster	Miranda Reed, Psychology
Anne N. Lucke-Wold	Bio & Health Sci #21	Nursing	West Virginia U.	Taura Barr, Nursing/Emerg. Med.
Shauna Novobilsky	Bio & Health Sci #20	Biochemistry	Mercyhurst College	Valeriya Gritsenko, Human Performance
John Snow	Bio & Health Sci #15	Neuroscience	Vanderbilt U.	Eric Tucker, Neurobio. & Anatomy
Arthur Spirou	Ag & Env Sci #20	Physics/Eng.	Washington U. of St. Louis	Stanislaw Majewski, Radiology
Sarah Terrill	Bio & Health Sci #17	Neuroscience & Psych.	Baldwin-Wallace C.	James O'Donnell, Behav. Med. & Psychiatry
Kristina Welch	Bio & Health Sci #19	Neuroscience	Oberlin College	Steven Kinsey, Psychology

IV. Speakers at REU/SURE Events

Speaker	Affiliation	Group(s)	Topic
David Lederman	Dept. of Physics, WVU	WVNano REU	Basis Aspects Nanosci./Eng.
Barbara Foster	Dept. of Chemistry, WVU	WVNano REU & SURE	Laboratory Safety
Aniketa Shinde	Educ. & Outreach Coordinator	WVNano REU & SURE	Nanoscale Characterization, Nanofabrication Methods & STEM Outreach & Science Communication
Michelle Richards-Babb	Dept. of Chemistry, WVU	WVNano REU WVNano REU & SURE REU & SURE	Oral Present. Skills/Lab Notebks, Scientific Ethics, and Effective Poster Presentations
Linda Blake	Wise Library, WVU	WVNano REU & SURE	Scientific Search Tools
Constinia Charbonnette	WVU Office of Graduate Education & Life	REU & SURE	GRE Preparation, Graduate School Roundtable, and Prestigious Scholarships Workshops
Clint Springer	Assistant Prof., St. Joseph's U.	Biology REU & SURE	Career Mentoring & Work in Academia
Katie Stores	Grants Management Spec., WVU	SURE	Grant Writing Workshop
Matthew Powell	Chief Science Officer, Protea Biosciences Group	REU & SURE	Career Mentoring & Work in Industry
Melinda Hollander	Animal Compliance & Training Officer, Office of Research Integrity & Compl.	REU & SURE	Ethics of Animal Use & Care
Keith Garbutt	Dean of Honors College, WVU	SURE	Prestigious Scholarships
Mark Hoover	Government: NIOSH Energy	WVNano REU & SURE	Career Mentoring & Government Work

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

V. Websites

Need more information?
WVNano: http://wvnano.wvu.edu/index.html
WVNano REU: http://wvnano.wvu.edu/reu/
STEM SURE/International Experience: http://www.honors.wvu.edu/STEMSURE/home.html
Biology REU: http://biology.wvu.edu/nsf-reu
WVU Honors administered SURE: www.honors.wvu.edu/sure
WVU Center for Neuroscience SURI: http://www.hsc.wvu.edu/wvucn/Summer-Internships-(SURI)

VI. Acknowledgements

A. Personnel

WVNano REU
Michelle Richards-Babb, PI
David Lederman, co-PI
Corey Nida, Asst. to REU Director

STEM SURE
Michelle Richards-Babb, Director/Educ. Coord.
Corey Nida, Asst. to SURE Director & Class TA
With help from the staff in the Honors Office and in the ECAS Business Office

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

STEM SURE IRES/CAREER
Michael Shi, PI

WVU Honors administered SURE
Keith Garbutt, PI
Robin Caulkins, Class TA
Annie Williams, SURE Logistics & Administration
Ian Murray, SURE Logistics & Administration

SURI
George A Spirou, Director
Erica Stewart, Coordinator

Symposium Booklet
Michelle Richards-Babb
Corey Nida

Symposium Planning
Annie Williams
Keith Garbutt
Michelle Richards-Babb
Corey Nida

B. Financial Support

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

2. **Biology REU (PI: Richard Thomas)**
Sponsored by the NSF Division of Biological Infrastructure (DBI-1156627) and in part by the WVU Department of Biology and the WVU Eberly College of Arts and Sciences.

3. **STEM SURE**
Sponsored by the WVU Office of the Provost. Special thanks to Mridul Gautam, David Lederman, and Nigel Clark for their help in securing this funding for the 2012 program.

4. **STEM SURE IRES/CAREER (PI: X. Michael Shi)**
Travel funding sponsored by a National Science Foundation CAREER grant awarded to Michael Shi (CHE-0844602). Student stipends funded by WVU Office of the Provost through the STEM SURE program.

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

6. **WVU Center for Neuroscience SURI (Director: George A. Spirou, Program Coordinator: Erica Stewart)**
Funded by the Center for Neuroscience and the NIH/NIGMS CoBRE Grant 8P30GM103503.

7. **Research Symposium Monetary Prizes**
Sponsored by the WVU Office of the Provost through the STEM SURE program.

Biological and Health Sciences Category

Bio & Health Sci Index

Poster 1: *Associations between adolescents' alcohol-related secrecy and disclosure and both alcohol consumption and risky alcohol behavior*. **Amanda Hanrahan**, Elizabeth Yale, and Aaron Metzger.

Poster 2: *Dityrosine synthesis through oxidative coupling*. **Nicholas Burock** and Brian Popp.

Poster 3: *Investigation of analog vs. digital signaling in motor control systems*. **Hirsh Parikshak** and Jim Belanger.

Poster 4: *Agroclavine to elymoclavine: a genetically unresolved oxidation in fungal ergot alkaloid biosynthesis*. **Sarah Robinson** and Daniel Panaccione.

Poster 5: *Do vitamin D serum levels modulate in men with prostate abnormalities, especially prostate cancer?* **Kayla Lantz** and Rajesh Naz.

Poster 6: *Relation between abusive parent's IQ and parent talk pre and post PCIT*. **Rachel DeRoos**, Jocelyn Stokes, and Cheryl McNeil.

Poster 7: *The impact of symbiont chorismate biosynthesis on tsetse (Diptera: Glossinidae) biology.* **Brett Clark**, Anna Snyder, and Rita Rio.

Poster 8: *Developing experimental procedures to test odor discrimination in moths with short, natural stimuli*. **Jenna Brandt**, Erich Staudacher, and Kevin Daly.

Poster 9: *Expression of transcription factors involved in lipid metabolism in mice fed algae, yeast, or fish oil*. **Loren Clevenger**, John Kentz, Mary Rodavich, and Kimberly Barnes.

Poster 10: *Passive mechanical properties of crustacean walking legs*. **Kartik Motwani** and Jim Belanger.

Poster 11: *An investigation of motivational effects on associative learning in Manduca sexta*. **Stephen Sutton** and Kevin Daly.

Poster 12: Tau-mediated memory deficits in a novel location recognition task. **Khoa Lenguyen**, Holly Hunsberger, Catherine Kelly, Ethan Hotz, Jessica Povroznik, and Miranda Reed.

Poster 13: *Effects of leading marker duration in an auditory gap detection task*. **Bennett Alterman**, David Sloan, and Albert Berrebi.

Poster 14: *Astrocytes and their role in synaptogenisis in the MNTB*. Brian Chen, Glen Marrs, and **George Spirou**.

Poster 15: *c-Jun N-terminal kinase activity is required for perpetuation of migratory streams in the developing cerebral cortex*. **J. P. Snow**, A.K. Myers, E.S. Tucker.

Poster 16: *Improved fixations to personally familiar and political disliked faces in response to compassion meditation training*. **Michelle Holcomb**, Vera Filatova, Julie Brefczynski-Lewis.

Biological and Health Sciences Category

Poster 17: *Characterizing the pharmaceutical potential of novel phosphodiesterase-4 modulators*. **Sarah Terrill**, Jonathan Klabnik, and James O'Donnell.

Poster 18: *Muscle music: a comparison of harmonious locomotion in a well trained, high-precision task to the discordant kinetics of a quickly adapted, low-precision locomotion task*. **Evguenia Ivakhnistkaia** and Sergiy Yakovenko.

Poster 19: *Anxiolytic effects of ethanol and monoacylglycerol lipase inhibition in mice*. **Kristina Welch**, Kelsey Wilson, Austin Sanders, and Steven G. Kinsey.

Poster 20: *The modulation of corticospinal excitability during reaching in a virtual environment*. **Shauna Novoblisky** and V. Gritsenko.

Poster 21: *MMP-9 as a peripheral marker of brain injury*. **Noelle Lucke-Wold**, Stephanie Rellick, Reyna VanGilder, Jason Huber, Brian Yung, Charles Rosen, and Taura Barr.

Biological and Health Sciences Category

Bio & Health Sci Poster 1:

Associations between adolescents' alcohol-related secrecy and disclosure and both alcohol consumption and risky alcohol behavior

Amanda Hanrahan, Elizabeth Yale, and Aaron Metzger

Department of Psychology, West Virginia University, Morgantown, WV 26506

Youth alcohol consumption is associated with negative outcomes including increased risk-taking behavior, poorer academic performance, and increased risk of alcoholism later in life, but developmental research finds that parents' knowledge of their adolescents' activities protects against problem behavior. Parental knowledge is most strongly predicted by adolescents' communication behavior including increased disclosure and decreased secrecy. The current study focuses on associations between adolescents' alcohol-related secrecy and disclosure and both alcohol consumption and risky alcohol behavior using a sub-sample of adolescents ($N = 45$, $M_{age} = 15.13$, 71% female). Regression analyses indicated that parental rules about alcohol were related to lower levels of alcohol consumption. Disclosure about alcohol behavior was associated with lower levels of alcohol consumption for boys but not girls. Adolescent secrecy predicted higher levels of engagement in risky alcohol behaviors for boys but not girls. These findings point to the potential utility of considering gender differences in secrecy and disclosure about specific problem behaviors such as alcohol use.

Bio & Health Sci Poster 2:

Dityrosine synthesis through oxidative coupling

Nicholas Burock and Brian V. Popp

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

Chemical cross-linking of tyrosine and tryptophan residues in proteins is a well-established means of altering protein structure and function. Dityrosine, created in tyrosine cross-linking, forms a mimic of binol, a privileged chiral ligand, which is being pursued in the Popp Lab as a modular ligand scaffold for asymmetric catalysis. Three short alanine rich peptides with two tyrosines spaced by 2-4 residues were prepared by solid-phase peptide synthesis and purified by reversed-phase high performance liquid chromatography (RP-HPLC). These peptides were chosen to determine if tyrosine residue proximity affected reactivity. Oxidation procedures were chosen based on their precedented ability to form tyrosyl radicals, leading to oxidative coupling. Oxidation was done with horseradish peroxidase/H_2O_2, Fe(II) salts/H_2O_2 (Fenton conditions), Cu(II) salts/H_2O_2, cerium ammonium nitrate, and diacetoxyiodobenzene. Reactions were monitored by analytical RP-HPLC by observing the characteristic absorbance and emission bands of dityrosine at 315nm and 410 nm respectively, and by LC-MS to observe a characteristic mass loss upon oxidation. Analysis of each reaction showed no strong evidence of cross-linking. Alterations to the current reaction methods will be necessary to yield oxidatively-coupled dityrosine product.

Biological and Health Sciences Category

Bio & Health Sci Poster 3:

Investigation of analog vs. digital signaling in motor control systems

Hirsh Parikshak and Jim Belanger

Department of Biology, West Virginia University, Morgantown, WV, 26506

Both vertebrates and invertebrates, specifically Arthropods, face similar challenges in motor control, and they utilize different tactics to control their movement in the face of environmental challenges. Of interest is the difference in analog and digital signaling in their nervous pathways, whereas information transfer capability and energy efficiency may vary. The difference lies past the alpha motorneuron at the motor output pathway, where integration occurs in Arthropod motor systems at multiple points while the Mammalian systems have almost no integration. To investigate this further, MATLAB and Simulink were used to analyze and modify pre-existing models of mammalian systems to mirror the arthropod system. Simulations with these models will be used to determine the total energy output from both systems, and we will look at specific locations in the model that might be responsible for the contrasting tactics. Findings from this research will reinforce our understanding of nervous signal processing and can be applied to robotics and prostheses.

Bio & Health Sci Poster 4:

Agroclavine to elymoclavine: a genetically unresolved oxidation in fungal ergot alkaloid biosynthesis

Sarah L Robinson and Daniel G Panaccione

Division of Plant and Soil Sciences, West Virginia University, Morgantown, WV, 26506

Ergot alkaloids are a group of agriculturally and medically important secondary metabolites synthesized by several fungi. While most of the genes required for the process are known, the gene that is needed to oxidize the pathway intermediate agroclavine to elymoclavine has not been identified. Two genes, *easD* and *cloA*, encode enzymes that oxidize the relevant carbon in agroclavine during other pathway steps. These genes were amplified by polymerase chain reaction using DNA from a *Neotyphodium* strain called Lp1. Both candidate genes were attached to the gene easA, from Lp1, and the promoter region of the human pathogenic fungus *Aspergillus fumigatus*. The genes were inserted into an *A. fumigatus* strain that cannot make agroclavine because of a defect in the gene *easA*. All transformation colonies were analyzed by high performance liquid chromatography. Successful transformants containing *easD/easA* synthesized agroclavine, as did those containing *cloA/easA*. We conclude that neither *easD* nor *cloA* is the gene needed to oxidize agroclavine to elymoclavine. Understanding the ergot alkaloid pathway may lead to advances in medicine and pharmaceuticals.

Biological and Health Sciences Category

Bio & Health Sci Poster 5:

Do vitamin D serum levels modulate in men with prostate abnormalities, especially prostate cancer?

Kayla Lantz and Rajesh K. Naz

Reproductive Immunology and Molecular Biology Lab, Department of Obstetrics and Gynecology, West Virginia University School of Medicine, Morgantown, WV 26506

Vitamin D is a pre-hormone vital for growth and development. Recently, it has drawn considerable attention, especially for its role in carcinogenesis. The involvement of vitamin D in men with prostate abnormalities (prostatitis (PT)/benign prostate hyperplasia (BPH)/prostate cancer (PC)) has not been investigated. The present study was conducted to examine its role in prostate abnormalities, especially prostate cancer. The levels of vitamin D and its binding protein were measured in the sera of men [PT (n=20), BPH (n=30), PC (n=30)] with various prostate abnormalities and compared with those in normal men (n=20). Vitamin D levels, measured by specific ELISA and mass spectrometry, were found to be significantly lower ($p=0.01$) only in the prostate cancer patients and not in other prostate abnormalities. The binding protein levels, measured by specific ELISA, were found to be significantly lower ($p<0.05$) in BPH sera than prostate cancer sera. All of these findings indicate that vitamin D may be involved in prostate carcinogenesis. A clinical trial on vitamin D supplementation in prostate cancer patients is warranted.

Bio & Health Sci Poster 6:

Relation between abusive parent's IQ and parent talk pre and post PCIT

Rachel M. DeRoos, Jocelyn O. Stokes, and Cheryl B. McNeil

Department of Psychology, Morgantown, WV 26506-6040

This study examined the differences in parent child interactions between abusive parents with high IQs and with low IQs based on their Kaufman Brief Intelligence Test scores. It was hypothesized that abusive parents with higher IQs would have more overall and neutral talk, affirmations, and fewer commands and criticisms than abusive parents with lower IQs. Additionally, it was hypothesized that abusive parents with higher IQs would have superior PCIT skills post PCIT in comparison to abusive parents with lower IQs. This study analyzed the data on an abusive sample obtained by the National Archive for Child Abuse and Neglect through Cornell University. The participants behavior was examined using the Dyadic Parent-Child Interaction Coding System (DPICS). The participants completed five minutes of child led play. The IQ of the parents, parent praise, parent commands, parent negative talk, parent neutral talk, and parent overall talk were examined and it was found that there was no correlation between pre parent talk and IQ.

Biological and Health Sciences Category

Bio & Health Sci Poster 7:

The impact of symbiont chorismate biosynthesis on tsetse (Diptera: Glossinidae) biology

Brett A. Clark, Anna K. Snyder, and Rita VM Rio

Department of Biology, West Virginia University, Morgantown, West Virginia, USA

Tsetse flies (Diptera: Glossinidae) are the obligate vectors of African trypanosomes and harbor a limited microbiota consisting of two enteric bacterial symbionts, *Wigglesworthia glossinidia* and *Sodalis glossinidius*. Comparative genomic analyses of *Wigglesworthia* isolated from *Glossina morsitans* (Wgm) and *Glossina brevipalpis* (Wgb) reveal the unique retention of the chorismate biosynthesis pathway by Wgm, synthesizing an intermediate in the production of aromatic compounds (e.g. folate) and amino acids (i.e. phenylalanine). Moveover, while Wgm is deficient in only one locus, *pheA*, required for the conversion of chorismate to phenylalanine, *Sodalis* encodes this gene, suggesting potential metabolic interactions. Notably, the *Trypanosoma brucei brucei* genome lacks these biosynthetic capabilities, yet retains compatible transporters for import. These studies aim to determine the significance of Wgm chorismate production towards tsetse host longevity and digestion by examining the impact of pathway inhibition. We also investigated expression of *Sodalis pheA* during trypanosome challenge through reverse transcriptional analyses. Results show that inhibition of chorismate biosynthesis decreases tsetse digestion and survival. Differences in symbiont biosynthetic capacities may contribute towards unique host species phenotypes, including vector competence.

Bio & Health Sci Poster 8:

Developing experimental procedures to test odor discrimination in moths with short, natural stimuli

Jenna M. Brandt, Erich M. Staudacher, Kevin C. Daly

Department of Biology, West Virginia University, Morgantown, WV 26506

The moth, *Manduca sexta,* is a model organism for studying olfactory processing in the brain. Pavlovian conditioning has been used to relate behavioral aspects of odor processing. Previously, 4 second stimuli were used to determine odor detection and discrimination thresholds. In nature, however, moths are only exposed to odors briefly. Here, moths were differentially conditioned to two neat odors using 4 second presentations and sucrose reinforcement. 24 and 48 hours afterwards, moths were tested using 100 millisecond stimuli of an odor dilution series. To ensure that these short stimuli reach the antenna, it was placed in a glass tube. Two control experiments were performed to determine if the glass tube and mechanical manipulations affect learning. Both use 4 second stimuli, one conditioning with the glass tube, one without. Results of these controls will be compared to previous studies to decide if procedures for testing odor discrimination with 100 millisecond stimuli need adjusting. Preliminary results indicate that the glass tube has little effect on discrimination, thus experimental procedures probably do not need to be changed.

Biological and Health Sciences Category

Bio & Health Sci Poster 9:

Expression of transcription factors involved in lipid metabolism in mice fed algae, yeast, or fish oil

Loren T. Clevenger, John Kentz, Mary Rodavich, and Kimberly Barnes

Division of Animal and Nutritional Sciences, West Virginia University, Morgantown, WV, 26506

Omega-three fatty acids have been shown to have numerous health benefits with respect to cardiovascular disease including reducing serum cholesterol levels. The major omega-three fatty acids that contribute to these benefits are docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA). Fish oil contains high levels of both DHA and EPA while algae oil (AO) contains DHA but not EPA and yeast oil (YO) contains EPA but not DHA. In this study, we examined mRNA samples from livers of mice who had been fed a diet containing soy oil (SO; no DHA or EPA), FO, AO, YO, or AO+YO. The mRNA was reverse transcribed and then amplified with primers for different transcription factors that have a role in fat metabolism. Transcription factors tested thus far include SREPB-1c and PPAR-γ. Determination of transcription factors with altered expression could indicate a mechanism by which the health beneficial omega-three fatty acids act.

Bio & Health Sci Poster 10:

Passive mechanical properties of crustacean walking legs

Kartik Motwani and Jim Belanger

Department of Biology, West Virginia University, Morgantown, WV 26506

Control of locomotion can be easily explained in steady models, the traditional interactions of actin/myosin protein fibres and neural impulses. The dynamic stability of an organism in rapid motion with many perturbations experienced over natural terrain may be due to the intrinsic elastic properties of muscle. This has become more evident by modeling with several decapod crustacean species of varied swimming ability. Passive legs are oscillated using a muscle force-clamp system at a range of frequencies and displacements similar to natural behavior. Areas of force vs. displacement plots are then analyzed to compare the mechanical work absorbed. Investigation of these preflexes brings to note varied mechanical properties between legs (first through fourth walking leg), and between species. Compared to others, the last two walking legs, generally the pair modified for use in swimming, exhibit an increase in induced force as frequency of oscillation increases, but a decrease as amplitude increases. Between the species of crayfish (Procambarus clarkii), spider crabs (Libina emarginata), and ghost crabs (Ocypode quadrata), increased swimming capability amplifies these observations.

Biological and Health Sciences Category

Bio & Health Sci Poster 11:

An investigation of motivational effects on associative learning in *Manduca sexta*

Stephen G. Sutton and Kevin C. Daly

Department of Biology, West Virginia University, Morgantown, WV 26506

Pavlovian conditioning has long been used in experimenting with olfactory learning in insects. Despite this research, the effects of motivation on learning and retention on this type of learning are not well understood. In order to achieve a better understanding of these effects, I have studied how an increased motivation to feed will influence the learning of the sphinx moth, *Manduca* sexta. I have conditioned each moth to associate the odorant 2-hexanone with sugar water and then tested those moths 24 hours after conditioning for a conditioned feeding response. A response indicates that the moth has successfully associated the odorant with the water. To vary the motivation to feed I used this protocol on moths of varying ages from 1 to 7 days old. Through my work on this project I was able to show that generally, as motivation to feed increased, the probability of a conditioned response increased. Thus I would conclude that motivation to feed is playing a significant role in the learning of a conditioned stimulus in *M. sexta.*

Bio & Health Sci Poster 12:

Tau-mediated memory deficits in a novel location recognition task

Khoa Lenguyen, Holly Hunsberger, Catherine Kelly, Ethan Hotz, Jessica Povroznik, and Miranda N. Reed

Behavioral Neuroscience, Psychology Department, West Virginia University, Morgantown, WV 26506

Hyperphosphorylated tau contributes to the pathogenesis of Alzheimer's disease (AD) by disrupting neuroplasticity at the early stage of disease and subsequently inducing neuron loss. The rTgTauP301L mouse exhibits tau hyperphosphorylation, memory deficits, and synaptic dysfunction found in AD. We utilized a novel object location (NoL) recognition task to assess hippocampus-dependent spatial memory of rTgTauL301L mice for two delay periods, 2 hours (short-term memory) and 24 hours (long-term memory). Despite our prediction that hyperphosphorylated tau would produce spatial memory deficit in rTgTauP301L mice, there were no significant differences in novel location recognition between rTgTauP301L mice and transgene negative mice (TgNeg) or mice expressing wild-type human tau (TauWT) mice for the 2 and 24 hour delays. The novel discrimination ratio was significantly higher for TgNeg mice compared to TauWT mice after the 2 hour delay (p=0.02). Total exploration time for TauWT mice was also significantly greater than that of TgNeg or TauP301L mice. Future studies will control for total exploration time by requiring mice to explore each object for a set duration before the trial ends.

Biological and Health Sciences Category

Bio & Health Sci Poster 13:

Effects of leading marker duration in an auditory gap detection task

Bennett L. Alterman, David M. Sloan, and Albert S. Berrebi

Center for Neuroscience and Department of Otolaryngology, West Virginia University, Morgantown, WV, 26506

The Superior Paraolivary Nucleus (SPON), a nucleus in the Superior Olive, is a significant source of GABAergic inhibition in the rat auditory midbrain. SPON neurons fire spikes during temporal discontinuities in auditory stimuli, such as sound offsets or gaps, as a result of a post-inhibitory rebound response. The effect of stimulus durations on SPON neuron firing in shorts gaps has yet to be defined. We performed a "Gap Leading Duration" (GLD) Test, comparing unit spiking during a 0ms and 2ms gap between markers as the duration of the leading marker was varied in length. Leading markers varied from 10-100 ms and lagging markers were maintained at 50 ms. We found that a 2 ms gap yielded more spikes and the spike count plateaued earlier than a 0 ms gap by 10 ms. This may give more information about the role the SPON plays in encoding gap signals which are a major cue for vocal communication.

Bio & Health Sci Poster 14:

Astrocytes and their role in synaptogenisis in the MNTB

Brian Chen, Glen Marrs, and George Spirou

Center for Neuroscience and Department of Otolaryngology, West Virginia University, Morgantown, WV, 26506

The calyx of Held found in the medial nucleus of the trapezoid body (MNTB) is one of the most well studied models for synapses in the brain. However, the role of astrocytes in these large synapses has only very recently begun to be uncovered. Using whole cell segmentation to create three dimensional reconstructions of the neural architecture in the MNTB at multiple ages, we note the prominence of the blockade effect that astrocytic glial shelves have on synaptic development. With this incredibly more detailed view of the calex, we are able to derive more educated theories of synaptogenisis. From a physiological angle, we investigated stimulated activation of astrocytes in the MNTB of mice much younger than previously studied to allow us to better define anatomical changes that occur in astrocytic response and function during calyx formation. These experiments will help us better understand the participation of glial cells in synaptic development through communication with pre and postsynaptic neurons.

Biological and Health Sciences Category

Bio & Health Sci Poster 15:

c-Jun N-terminal kinase activity is required for perpetuation of migratory streams in the developing cerebral cortex

J. P. Snow[3], A.K. Myers[1,2], E.S. Tucker[1]

[1]Neurobiology and Anatomy, [2]Neuroscience Graduate Program, [3]SURI Program, West Virginia University School of Medicine, Morgantown, WV

Correct assembly of cortical circuitry requires precise spatial and temporal control of neuronal migration. During cortical development, interneurons disengage from tangential migratory streams, turn radially, and enter the nascent cortical plate, where they ultimately synapse. The molecular cues causing interneurons to switch modes of migration are poorly understood, but are critical for understanding how interneurons are functionally integrated into cortical circuits. Previous studies in E12.5 mice indicate that inhibition of c-Jun N-terminal kinase (JNK) signaling impairs entry of interneurons into the cerebral cortex. Here, live imaging was performed at E14.5—a time point after which interneurons have entered the cortex and formed migratory streams—was performed in control media or media containing a pan-JNK inhibitor. Loss of JNK functionality caused stream disintegration, and precocious entry into the cortical plate. These data suggest JNK activity is required for preservation of tangential migration, and elimination of JNK activity is required for stream exit and deposition of cortical interneurons. Thus, disruption of JNK activity may lead to aberrant formation of cortical circuitry and susceptibility to neurological disorders.

Bio & Health Sci Poster 16:

Improved fixations to personally familiar and political disliked faces in response to compassion meditation training

Michelle Holcomb, Vera Filatova, Julie Brefczynski-Lewis

Department of Physiology/Radiology, West Virginia University, WV, 26506

Inherent physiological changes, such as heart rate and cortisol levels, increase when people are presented with stressful stimuli. It is known that these physiological responses can be reduced with the aid of compassion meditation training. However, not much is known about the impact of this training on the psychological stress response of eye movement behavior. Stimuli of personally familiar and political disliked faces were superimposed on neutral backgrounds of nature scenes to study the effect compassion mediation training has on eye movement behavior. We hypothesized that when initially presented, participants would spend less time fixating on the disliked faces vs. unfamiliar and liked faces, but after training, time of fixation for each condition would be equivalent. Pupil movements were recorded via *iViewX* eye tracker and software, salivary cortisol samples were taken via *Salvettes*, and heart and respiratory rates were observed via *FaceAnticipation* software. Although incomplete, preliminary analysis revealed a trend of increased heart rate in response to narratives about the disliked persons, which correlated with self-report measures of stress. Further analysis will determine whether eye gaze aversion correlates with stress ratings and physiological related stress measures.

Biological and Health Sciences Category

Bio & Health Sci Poster 17:

Characterizing the pharmaceutical potential of novel phosphodiesterase-4 modulators

Sarah Terrill, Jonathan Klabnik, and James O'Donnell

Center for Neuroscience and Department of Behavioral Medicine and Psychiatry, West Virginia University, Morgantown, WV 26506

Phosphodiesterases (PDEs) are a superfamily of enzymes that regulate levels of cAMP and cGMP by breaking down these second messengers into their monophosphate counterparts. Presently there are eleven PDE families that have been identified, each with a multitude of splice variants and a plethora of functional roles based on their location within the cell and the body at large. PDE inhibition has significant potential in drug development as a means of precise modulation of neuronal activity due to the regioselective characteristics of PDEs and their variants. One family highly implicated with the breakdown of cAMP is PDE4, making them an ideal target for a host of disorders, particularly within the nervous system. Unfortunately, the use of PDE4 inhibitors is limited due to side effects. A novel approach to overcome these limitations is the development of PDE4 modulators, which help favor the enzyme's inactive, or closed state. The purpose of the current study is to utilize these PDE4 allosteric modulators in an *in vitro* cellular model. The ramifications of this research may help in the development of neuronally active drugs that target the PDE4 system, as well as the phosphodiesterase family at large.

Bio & Health Sci Poster 18:

Muscle music: a comparison of harmonious locomotion in a well trained, high-precision task to the discordant kinetics of a quickly adapted, low-precision locomotion task

Evguenia Ivakhnistkaia and Sergiy Yakovenko

Center for Neuroscience and Department of Human Performance – Exercise Physilogy

Understanding the mechanisms behind long-term adaptation in precise movement is critical to the creation of effective rehabilitation techniques and robotic prosthetics for people impacted by movement disorders. While uncoordinated movements of limbs are a common outcome of stroke, the mechanism responsible for the retraining of coordination in muscle synergies remains unknown. The goal of this study was to contrast short-term and long-term adaptation in stereotypical arm and leg movements that require different levels of precision in muscle coordination. We have collected preliminary data from 2 subjects during a low-precision, quickly learned asymmetric locomotion task and 2 extensively trained violinists, who performed highly precise bow movements in a music performance task. The dataset consisting of 16 electromyographic signals from major muscle groups and the 3D kinematics of body segments engaged in these tasks is currently under analysis.

Bio & Health Sci Poster 19:

Anxiolytic effects of ethanol and monoacylglycerol lipase inhibition in mice

Kristina Welch, Kelsey Wilson, Austin Sanders, and Steven G. Kinsey

Department of Psychology, West Virginia University, Morgantown, WV 26506

Anxiety disorders are a pervasive health problem in the United States. Many people who feel anxiety self-medicate with alcohol or marijuana (*Cannabis*). Endocannabinoids (i.e., endogenously produced cannabis-like compounds) lack many of the psychomimetic and cognitive side effects of cannabinoids, and so present a possible therapeutic alternative to current treatments of anxiety. The purpose of this experiment was to test the hypotheses that (1) ethanol or (2) endocannabinoids decrease anxiety-like behavior in mice. We examined the effects of ethanol and the endocannabinoid modulator, JZL184, in the marble burying test, a commonly used screen for anti-anxiety drugs. JZL184 increases brain levels of the endocannabinoid 2-arachydonoyl glycerol (2-AG) by inhibiting monoacylglycerol lipase, the primary catabolic enzyme of 2-AG. Spontaneous locomotor activity was also assessed for possible sedative confounds. In the present study, ethanol dose-dependently decreased the number of marbles buried (1500 mg/kg = 10.8; controls = 21.5). Similarly, JZL184 significantly decreased marble burying behavior (20 mg/kg = 8.8; controls =18.3). These data suggest that both ethanol and endocannabinoid modulation decrease anxiety-like behavior in mice.

Bio & Health Sci Poster 20:

The modulation of corticospinal excitability during reaching in a virtual environment

Shauna Novoblisky[1] and V. Gritsenko[2]

[1]Center for Neuroscience SURI program and [2]Center for Neuroscience, Department of Human Performance

In order to make a precise movement, the sensorimotor system must overcome the inherent complexities of the musculoskeletal system. For example, contraction of a single arm segment causes passive joint torques that propagate to other segments causing movement. However, the mechanistic description of the control system requires careful examination of both dynamic and kinematic movement attributes in movements representing full 3D workspace environment. The goal of this project is to use a virtual-reality system (Worldviz) together with motion capture (PhaseSpace), electromyography (Delsys), and transcranial magnetic stimulation (TMS, Magstim) to investigate corticospinal excitability during movements with different dynamics. During the course of SURI we have successfully developed the integrated human neurophysiological setup and tested it during a goal-directed reaching task. We found that motion capture and electromyography data could be recorded simultaneously and TMS responses identified at different times during movement.

Bio & Health Sci Poster 21:

MMP-9 as a peripheral marker of brain injury

Noelle Lucke-Wold[1], Stephanie Rellick[1], Reyna VanGilder[1,2], Jason Huber[3], Brian Yung[4], Charles Rosen[4], Taura Barr[1,2]

[1]School of Nursing, [2]Emergency Medicine, [3]Basic Pharmaceutical Sciences, [4]Neurosurgery

We have identified a significant relationship between blood expression of MMP9, ischemic stroke (IS) and blood brain barrier disruption (BBBD). The purpose of this pilot study was to further characterize the relationship of MMP9 protein expression across various brain injury groups to confirm its diagnostic potential for stroke and stroke related complications. This is a human descriptive study observing levels of MMP-9 at one time point post brain injury. Peripheral blood was drawn from subjects >18 years of age with a diagnosis of IS (n=4), transient ischemic attack (TIA) (n=4), stroke mimic (n=5) and traumatic brain injury (TBI) (n=8) within 24 hours of symptom or injury onset. Blood was collected in serum tubes, centrifuged within one hour of collection, and serum was frozen at -80°C until analysis. ELISA was performed to determine the protein expression of serum MMP-9 in duplicate. Mean concentrations were calculated for each subject, and each group. Descriptive statistics were performed in SPSS v20. The difference between each group was determined by ANOVA. Multinomial logistic regression was used to identify the predictive ability of MMP9 for diagnosis when controlling for age. A total of 21 patients were recruited. The mean age of the sample was 62, from mild, moderate to severe brain injuries. Serum level of MMP-9 was significantly different between all groups (p=0.008). The highest levels were found in TBI patients (mean=5529 pg/ml) and the lowest levels in IS patients (mean= 3343 pg/ml). There was a significant difference between IS, TIA and TBI (p=0.018). When controlling for age, MMP9 remained a significant predictor of diagnosis for TBI. (p=0.051). MMP-9 may be a relevant maker for use in the clinical setting to differentially diagnosis and predict brain injury related complications. There is a significant relationship between MMP-9 expression, TIA and TBI that is not well characterized. Further work is necessary to confirm the functional relevance of MMP9 with severity of brain injury and outcome in these populations.

Agricultural and Environmental Sciences Category

Ag & Env Sci Index:

Agricultural and Environmental Sciences Category

Poster 16: *Topographies of taste: evaluating the role of altitude and place in coffee quality*. **Emily Eddy** and Bradley Wilson.

Poster 17: *Synthetic steroids: cause of hermaphroditic fish mutation*. **Cody Mitchell**, Fan Alison Hanyu, Vince Nyakubaya, Jennifer Stueckle, and Lisa Holland.

Poster 18: *Different dietary sources of omega-3 polyunsaturated fatty acids influences renal fatty acid composition, gene expression, and risk of nephrocalcinosis in female rats*. **Christopher Oldaker**, Joseph Gigliotti, Vagner Benedito, and Janet Tou.

Poster 19: *Effects of soy protein isolate and/or omega-3 polyunsaturated fatty acid supplementation on bone health in female rats with polycystic kidney disease*. **Matthew Miller**, Kaitlin Maditz, and Janet Tou.

Poster 20: *Adaptation of the PET detector ring for a brain-imaging inset in the 3 telsa MRI machine*. **A. Spirou**, A. Badia, C. Bauer, N. Nair, A. Stolin, J. Lewis, J. Brefczynski-Lewis, R. Raylman, and S. Majewski.

Poster 21: *Fatty acid composition of adipose tissue of mice fed yeast, fish, or algae oil containing diets.* Danielle Empson, John Ketz, Mary Roavich, and Kimberly Barnes.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 1:

Neighborhood physical disorder in comparison with tree characteristics in Morgantown, WV

Anna E. Koebley[1], Jamison F. Conley[2], and Clinton E. Davis[2]

[1]*Undergraduate Student at Allegheny College Meadville, PA 16335*
[2]*Department of Geology and Geography, West Virginia University, Morgantown, WV 26506*

This study examines relationships between neighborhood disorder and tree characteristics in Morgantown, WV. A standardized sociology technique to measure physical disorder, systematic social observation (SSO), was taken in six neighborhoods in Morgantown. The USDA Forest Service provided data on health and size of Morgantown's street trees. Geographic Information Systems (ArcGIS 10) was used for ordinary least square and geographically weighted regressions. Results suggest a weak, but statistically significant correlation associating physical disorder with healthier trees in the three neighborhoods so far analyzed ($p<0.02$; R^2 from 0.023 to 0.101). However, a combined analysis of these neighborhoods does not show a significant correlation ($p=0.315$). Higher disorder correlates with smaller trees in Sunnyside, larger trees in Suncrest, and no significant correlation in South Park. The combined analysis shows a very weak yet significant correlation between higher disorder and smaller trees ($p=0.008$; $R^2=0.006$). Analysis of percent tree cover is ongoing and will include additional neighborhoods. The low R^2 values suggest that while disorder is related to tree health and size, there are many other factors affecting Morgantown's urban forest.

Ag & Env Sci Poster 2:

Characterization of ethylene-responsive transcription factors (*ERF*s) in *Petunia* x *hybrida*

Haley Dugan, Youyoun Moon, and Nicole Waterland

Division of Plant and Soil Sciences, West Virginia University, Morgantown, WV 26506

The plant hormone ethylene plays an integral role in developmental processes and physiological response to environmental stress. However, very little is known about the regulation of ethylene-response genes by ethylene-responsive transcription factors (*ERFs*). *ERF*s are thought to be highly involved in various biotic and abiotic stress responses, but their specific mechanisms remain unknown. In this study, 13 *ERF* genes were isolated from *Petunia* x *hybrida* and their transcript abundance was measured in response to flower senescence and drought stress. *PhERF*s *2*,*3*,*5*,*10* and *13* displayed differential expression patterns in response to senescence and drought stress and were targeted for potential involvement in these processes. These *PhERF*s were cloned into petunia and transiently over-expressed and under-expressed in order to characterize their function. The role of *PhERF* genes in the transcriptional regulation of the senescence process and the drought stress response will be analyzed and discussed in this study. Understanding the molecular mechanisms of *ERF* involvement in the senescence process and the drought-stress response in petunia could elucidate genetic engineering mechanisms for many cash crops in the agricultural industry.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 3:

Nitrogen cycling in high elevation red spruce forests along an atmospheric deposition gradient

Justin M Mathias, Kenneth R Smith, and Richard B Thomas

Department of Biology, West Virginia University, Morgantown, WV 26506

Disjunct populations of red spruce (*Picea rubens*) persist at high elevations along the Appalachian Mountains. Throughout most of the species range, these unique forests have been exposed to high rates of atmospheric deposition due to increased industrial processes. Deposition of atmospheric pollutants, particularly reactive forms of nitrogen (N), can enhance or depress forest production depending on the intensity and duration of exposure. As such, the purpose of this experiment is to determine how soil N availability varies along a gradient of atmospheric deposition. I conducted a short-term soil incubation experiment to measure differences in microbial biomass as well as changes in soil nitrification and mineralization. Soil N concentrations were measured by colorimetric analysis of soil extracts, while microbial biomass was determined using the chloroform fumigation technique. These measurements will allow me to determine how soil N availability differs across a large spatial scale, and to investigate possible cascading effects on the carbon cycle.

Ag & Env Sci Poster 4:

Varying shade levels and their impact on retarding the bolting of lettuce

Heather R. Griffith and SvenVerlinden

Department of Plant and Soil Sciences, West Virginia University, Morgantown, WV 26506

In the production of lettuce (*Lactuca sativa*), bolting, or flowering before harvest, is undesirable as it leads to a product that cannot be sold and is unpalatable due to the accumulation of bitter compounds previously present in low levels. High heat and light are thought to influence the transition from vegetative development to bolting. In order to study the influence of light and heat levels on bolting of lettuce, we designed an experiment that will measure the effects of shading. Three shade levels, a control, 30% shade, and 50% shade were applied to 16m² plots. Each treatment was replicated four times and the twelve plots arranged in a Complete Randomized Block design. Ten plants each of the varieties Margarita and Buttercrunch were transplanted into each plot on July 11, 2012 and watered via drip irrigation to avoid drought stress. An additional ten plants of each will be sown in the same plots on July 18, 2012. Data is collected on light level, air temperature, and soil temperature at five minute intervals. Weekly measurements include the height and width of the plants in addition to visual observations. At the end of the experiment, a destructive harvest of the plants will allow us to collect data on fresh and dry weight accumulation and perform taste tests.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 5:

Does species composition drive canopy-level albedo? Evidence from leaf area index and leaf angle distribution

Matthew Mayher[1], Kenny Smith[1], Chris Walter[1], and Brenden McNeil[2]

[1]Department of Biology and [2]Department of Geology & Geography, West Virginia University, Morgantown, WV 26506

Forests in the central Appalachian Mountains often exhibit high foliar albedo and it has been proposed that differences in species composition may be primarily responsible. In order to understand how species composition affects canopy albedo, I measured species composition and canopy structure at multiple tulip poplar (*Liriodendron tulipifera)* and red spruce (*Picea rubens*) forests. Species composition was measured by making ordinal estimates of canopy cover and visually assessing canopy profiles, while canopy structure was measured using hemispherical photographs taken at ordinal points in each plot. Hemispherical photographs were then analyzed using CI-110 Plant Canopy Imager software from CID Bio-Science Inc. to determine leaf area index (LAI) and leaf angle distribution (LAD). I hypothesize that species composition will influence LAD and LAI and that plots with high canopy LAD will have high canopy-level albedo. Results show that the *L.tulipifera* sites exhibit greater LAD than the *P. rubens* sites. Understanding the driving factors of canopy-level albedo is important in estimating how forests help to mitigate the effects of climate change.

Ag & Env Sci Poster 6:

Searching for the role of SST1 transporter in symbiotic nitrogen fixation in *Medicago truncatula* nodules

Cameron Lewis, Christina Wyman, and Vagner Benedito

Laboratory of Plant Functional Genetics, Plant and Soil Sciences Division, West Virginia University

The study of symbiotic nitrogen fixation in legumes is an important factor for the improvement of sustainable agriculture. Legumes are the world's second most important agriculture crop and they provide both oils and proteins to human diets and animal feed. *Medicago truncatula* is an ideal legume model due to its genetics and availability of research tools. Through molecular cloning, we aim at determining the function of Medicago transporter genes involved in nitrogen fixation, including the coding sequence and promoter region of SST1, a potential sulfate transporter expressed specifically in nodule cells. Total RNA was isolated from Medicago nodules and cDNA was synthesized. The SST1 transcript was amplified via PCR and cloned into pENTR-TOPO vector, for insertion in destination vectors. Additionally, a 2-kb promoter sequence was amplified via PCR from the genomic DNA and was also cloned. The cDNA will be used to understand SST1 functional characterization. The promoter fragment will be used to assess the exact activity of the promoter in the nodule, to allow better understanding of the exact expression activity of this gene.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 7:

The importance of insertion/deletion polymorphisms to hybrid vigor in poplar

Joseph M. Tilghman, Eli Rodgers-Melnick, Rose Strickland-Constable, and Stephen P. DiFazio

Department of Biology, West Virginia University, Morgantown, WV 26506

Plant breeding programs are often designed to take advantage of the phenomenon of hybrid vigor or heterosis, in which hybrid offspring have more favorable traits than either of the parent species. A better understanding of the mechanisms behind this phenomenon in poplar trees may allow for more effective utilization of this process in the breeding of poplars for production of sustainable biofuels. To this end, we are investigating the network context and phenotypic effects of insertion/deletion (indel) polymorphisms in *Populus trichocarpa* identified using resequencing data from 83 trees. We have assayed 23 of these identified loci in 137 trees using multiplex PCR, allowing us to distinguish between the three diploid genotypes for each locus. Using these genotypes, we will be able to associate indel polymorphisms with commercially important traits and the number of protein-protein interactions of genes encompassed or flanked by the deletion sites. Further insight into the role of indels will help to elucidate the importance of divergent resolution in post polyploid evolution and to explain the causes of heterosis in poplar.

Ag & Env Sci Poster 8:

Establishment of the early steps in the ergot alkaloid pathway in *Aspergillus nidulans*

Tanya Lee Dilan, Katy Ryan, and Daniel G. Panaccione

Plant and Soil Sciences, West Virginia University, Morgantown, WV 26506

Ergot alkaloids are a group of mycotoxins that are significant in medicine and agriculture. There are many unknown questions about the early steps of ergot alkaloid synthesis. We are investigating these early pathway steps by generating a new strain of the ergot alkaloid nonproducing fungus *Aspergillus nidulans*. This strain was transformed with *dmaW* and *easf* genes, which function in the first two steps of the ergot alkaloid pathway. Both genes were amplified from the genome of the ergot alkaloid producer, *Aspergillus fumigatus* and united into one fragment by SOEing PCR. Transformants were analyzed using HPLC and mass-spectrometry. Positive strains showed the accumulation of the expected ergot alkaloid, N-methylDMAT. Interestingly, transformants also accumulated an unknown intermediate. This unknown ergot alkaloid was found to have a mass of 302 g/mol. We are currently obtaining further data to verify the chemical structure of this ergot alkaloid. Therefore, these new strains have provided us with additional knowledge of the early steps in the ergot alkaloid pathway presenting evidence of a new, uncharacterized ergot alkaloid.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 9:

Transcript abundance analysis of calcium-dependent-protein-kinase under drought and heat stress in *Petunia* x *hybrida*

Vincent A. Brazelton Jr[1,3], Youyoun Moon[2], and Nicole Waterland[3]

[1]Department of Agricultural Environmental Sciences, Tuskegee University [2]Department of Biology, [3]Division of Plant and Soil Sciences, West Virginia University Morgantown, WV 26506

Calcium-dependent protein kinase (CDPK) plays an essential role in various plant physiological processes, including growth and development as well as abiotic stress tolerance responses. CDPKs act as signaling molecules which oversee the production of various regulatory proteins in response to abiotic stimuli; however, it is unclear as to the functionality of protein kinases in relation to drought and heat stresses. The purpose of this experiment is to evaluate the differential expression of twelve calcium-dependent proteins in order to identify proteins specifically involved in the heat and drought stress pathways. Semi-quantitative PCR was performed on leaves of either drought or heat stressed Petunia leaves. *PhCDPK11* and *PhCDPK12* expressed higher transcript abundance under heat or drought stress compared to controlled Petunia, respectfully. *PhCDPK10* was lower under both stress conditions relative to unstressed control. Further experiments will be conducted to elucidate the exact involvement of these proteins in the drought and heat response pathways.

Ag & Env Sci Poster 10:

Phylogenetic analysis in the genus *Sorghum* using four nuclear gene sequences

Jonah N Joffe, Michael Carlise, and Jennifer S. Hawkins

Department of Biology, West Virginia University, Morgantown, WV, 26506

Evolutionary relationships in the genus *Sorghum* have proven difficult to discern due to its recent evolutionary origin and rampant gene flow resulting from interspecies hybridization. Traditional phylogenetic analyses employing morphological traits and chloroplast markers have failed to produce a clear picture of the genus's evolutionary history. Here, we present a phylogeny of *Sorghum* employing four regions from three nuclear genes and including five varieties of the domesticated species *S. bicolor*, one hybrid between *S. bicolor* and *S. propinquum*, and nine wild and widely-distributed species of *Sorghum*. Phylogenies were constructed using a maximum parsimony analysis of the combined data from all four sequenced regions and incorporating the same regions from the close relative *Zea mays* (maize) to serve as an outgroup for polarization of observed evolutionary changes. Our findings were mostly consistent with previous phylogenies of Sorghum, namely that those species containing 2n=10 chromosomes form a monophyletic clade, suggesting that there has been a reduction in ploidy level relative to the polyploid outgroup.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 11:

The effect of increased nitrogen saturation on the carbon storage of a temperate forest ecosystem

Joseph D Hilgenberg, Chris A Walter, Mark B Burnham, and William T Peterjohn

Department of Biology, West Virginia University, Morgantown, WV 26506

The cycling of nitrogen and carbon is important to any ecosystem, as both compounds are needed for growth in living organisms. A long-term fertilization experiment was used to determine the impact of high nitrogen saturation on carbon sequestration in a temperate forest ecosystem. In soils of higher nitrogen saturation, most tree species would exhibit increased growth, the rate of forest floor decomposition would decrease, and total soil respiration would decrease. Dendrometer bands were used to measure the growth of red maple, tulip poplar, black cherry, and sweet birch specimens within each watershed. Readings were collected on the CO_2 flux of the soil in both watersheds, as well as samples of the organic horizon to compare decomposition rates. Data analysis currently indicates there is no significant difference in total soil respiration due to nitrogen saturation of the soil, meaning that nitrogen saturation does not appear to influence total soil respiration. Further analysis of the remaining samples is required for further conclusions.

Ag & Env Sci Poster 12:

Understanding factors limiting restoration benefits and modeling effective mitigation sites

Todd J. Petty, Eric Merriam, Eric Miller, and Jakob Goldner

Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506

Increased public interest in environmental health has led to more awareness of current natural resource extraction methods, and their impacts on the ecosystem. In areas as focused on extractive industries as Appalachia, there are growing concerns about these impacts, and about ways to combat them. In the last ten years, there have been over 100 mining related stream mitigation projects in West Virginia. However, few of the benefits of mitigation are understood. In this project, we use a before-and-after-control-impact control design to 1) identify factors limiting restoration benefits in the southern coalfields of West Virginia: and 2) model the benefits of mitigation to aid in future selection of sites of restoration efforts. Our results provide criterion for selecting effective mitigation sites, including basin area, percent mining, and conductivity levels, and point to areas in the southern coalfields where mitigation may be beneficial.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 13:

Improving soil limiting conditions by growing the biofuel crop *Miscanthus sinensis*

Mason E McMonegal[1] and Eugenia Pena-Yewtukhiw[2]

[1]West Virginia University research assistant and [2]Associate Professor of Soil Science, Division of Plant and Soil Science, West Virginia University, Morgantown, WV 26505

Miscanthus sinensis, a perennial grass native to Asia, may produce high biomass yields on marginal soils while providing soil and environmental remediation. In organic farming, continuous high productivity is maintained through utilization of marginal soils without further environmental degradation. In this study at the West Virginia University organic farm, *M. sinensis* was grown under limiting soil conditions imposed by five levels of residual fertility treatments. Plant and soil physical properties were measured. Two years after planting, *M. sinensis* showed response to soil residual fertility levels, the highest yield and establishment occurred in medium to high fertility treatments. *M. sinensis* was able to utilize nutrients regardless of fertility level, with nutrient removal rates proportional to the nutrient availability in the soil, indicating high adaptability to limiting conditions and long term sustainability. *M. sinensis* is highly adaptable to conditions unfavorable for other crops and may produce a beneficial effect on soil physical characteristics improving environmental quality.

Ag & Env Sci Poster 14:

Linking past climate patterns and historical events in Mongolia using tree-ring data

Jennie L Zhu[1], John Q Burkhart[2], and Amy E Hessl[2]

[1]University of Minnesota, Twin Cities, MN 55455 and [2]Department of Geology and Geography, West Virginia University, Morgantown, WV 26506

The study of how climate change is related to historical events is part of a growing interdisciplinary field. The objective of this study was to examine whether we could connect climate information found in tree rings with historical events of the Mongolian nation from 1600-2010. Based on similar research conducted in China, we expect to see correlations of war with cool, dry climates and peace with warm, lush climates in our data. We used tree rings to develop a record about climate variability from one year to the next. A total of six tree-ring samples, each tracking temporal trends in climate, were obtained from cross sections of the tree species *Larix siberica* from the Khorgo Lava field in central Mongolia. Higher values of the index indicate more favorable growing conditions (cooler and wetter) and lower values suggest unfavorable conditions (hot and dry), which correlated with either stable political situations or wars and conquest. This information will help scientists gain a better understanding on historical developments in relation to climate change in this central Asian country.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 15:

Agronomic potential of ultra-low temperature biochar produced by solar pyrolysis

Kathryn M. Trupo and Louis M. McDonald

Division of Plant and Soil Sciences, West Virginia University, Morgantown, West Virginia 26506-6108

Alternative energy, sustainability, development of lasting soil amendments, and solutions for agricultural wastes are some of the foremost issues in the agricultural sciences. Biochar, or organic biomass that has been decomposed by an anaerobic thermal process called pyrolysis, may provide a solution to some of these concerns. Cow manure biochar produced at lower temperatures (between 100° and 240° Celsius) than traditional pyrolysis (>400 ° C) via an innovative solar-heating technique was characterized for plant available nutrients, plant growth response, and weed seed eradication. The weed seed and plant response results are pending. Preliminary results have indicated that both the 240° C and 100° C products after pyrolysis had concentrations of essential elements that exceeded those of the raw materials. The 240° C biochar proved to be more hydrophobic than the 100° C biochar; this quality may indicate potential for use in other capacities. The "ultra-low-temperature biochar," exhibits all the positive characteristics of organic soil amendments and shows promise when used in a manner similar to compost.

Ag & Env Sci Poster 16:

Topographies of taste: evaluating the role of altitude and place in coffee quality

Emily N. Eddy[1] and Bradley R. Wilson[2]

[1]Division of Sociology and Anthropology and [2]Department of Geology and Geography, West Virginia University, Morgantown, WV 26505

Coffee quality is a black box, an unquestioned entity, accepted by consumers and used by retailers for profit. Experts assert that altitude and place are determinants of coffee quality. In this study, we open this black box to assess the consistency of expert claims with the quality conclusions of the Cup of Excellence competition. Data from this competition was analyzed using qualitative geospatial visualization, comparing changes in flavor by altitude, country and region. The results indicated that at lower altitudes, place-based flavor profiles showed less variation between locales, but greater consistency in qualities evaluated, like chocolate, sweet, honey and caramel. Higher altitude coffees presented diverse flavors such as tea, jasmine, champagne, and hazelnut, without place-associated profiles. Moreover, altitude has a more significant effect on price with lower and higher altitude coffees generating lower and higher prices respectively. Therefore, we find that altitude is a greater determinant of perceived coffee quality than place. These conclusions are significant for consumers and retailers alike, who should be evaluating altitude, not place, for quality in buying and selling decisions.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 17:

Synthetic steroids: cause of hermaphroditic fish mutation

Cody Mitchell[1], Fan Alison Hanyu[1], Vince Nyakubaya[1], Jennifer Stueckle[2], and Lisa Holland[1]

[1]C. Eugene Bennett Department of Chemistry, West Virginia University and [2]Department of Biology, West Virginia University

Water treatment plants were developed to remove known contaminants from wastewater. These plants were never made with the concerns of modern pollutants such as pharmaceuticals. These chemicals disrupt the endocrine system, which leads to a number of diseases. Literature studies report that Japanese medaka fish suffer endocrine disruption when exposed to ethynylestradiol (i.e. the active ingredient in birth control pills). Often fertility and reproductive success are used as markers in fish toxicity studies. Circulating steroids are also biomarkers of endocrine disruption, but these are difficult to measure in small fish because their blood volume is 5 µL or less. We have adapted a microscale method to analyze multiple steroids in a single fish and are demonstrating the usefulness of circulating steroids by monitoring Japanese medaka fish. This shows that the fish mutation could be caused from exposure to synthetic steroids.

Ag & Env Sci Poster 18:

Different dietary sources of omega-3 polyunsaturated fatty acids influences renal fatty acid composition, gene expression, and risk of nephrocalcinosis in female rats

Christopher R. Oldaker[1], Joseph C. Gigliotti[2], Vagner A. Benedito[3], and Janet C. Tou[*2, 3]

[1]Department of Biology, [2]Human Nutrition and Foods, Division of Animal and Nutritional Sciences, [3]Genetics and Developmental Biology Program, Division of Plant and Soil Sciences, West Virginia University, Morgantown, WV 26506

Accumulating calcium in the kidneys (nephrocalcinosis) is associated with multiple renal disorders, including kidney stones (nephrolithiasis). Populations with low risk of nephrolithiasis have been shown to have a diet high in fish oil, a rich source of omega-3 fatty acids. There are various types of fish oil and omega-3 sources that may differ in their health properties. Female Sprague-Dawley rats were fed a high fat diet of corn oil or omega-3 rich flaxseed, krill, menhaden, salmon, or tuna oil. Gas chromatography revealed that renal fatty acid composition was dependent on dietary oil source. RT-PCR revealed that rats fed fish oils had reduced inflammation as indicated by lower COX-2 and TGF-β gene expression. Additionally, rats fed fish oils had lower renal NFκB and prostaglandin E_2 activity as determined by enzyme immunoassay. However, krill oil induced nephrocalcinosis due to the high phosphorous content associated with phospholipids. Feeding rats sources of omega-3 fatty acids mitigated the effects of nephrocalcinosis, but failed to prevent the emergence the disease brought on by a calcium:phosphorous imbalance.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 19:

Effects of soy protein isolate and/or omega-3 polyunsaturated fatty acid supplementation on bone health in female rats with polycystic kidney disease

Matthew Miller, Kaitlin Maditz, and Janet C. Tou

Division of Animal and Nutritional Sciences, Davis College of Agriculture, Forestry, and Design

Polycystic kidney disease (PCK) is a genetic disorder that results in multiple cysts. The cysts caused by PCK will decrease kidney function, which is strongly linked to mineral homeostasis and can compromise overall bone health. Limited treatment exists for PCK. Diets consisting of soy protein and diets consisting of omega-3 polyunsaturated fatty acids (n-3 PUFA) have been known to protect bone health and have shown some successes in decreasing PCK progression. The objective of this study is to determine whether diet supplementation with soy protein and/or n-3 PUFA affects bone health in rats with PCK. The PCK rats (n=12/group) were in four groups based on their diet composition, which could be Casein + Corn Oil, Casein + Soybean Oil, Soy Protein Isolate + Soybean Oil, or Soy Protein Isolate + Salmon Oil Blend. The PCK rats were fed these diets for 12 weeks. At the conclusion of the feeding period, the femurs and tibias' morphometry was determined. Bone strength was then determined by using the three-point bending test. The bone mineral content was determined by ashing the bones, after which calcium and phosphorous were determined using inductively coupled mass spectrometry. Depending on the results, this study can provide insight into the effectiveness of using diets as treatment for bone health in PCK patients.

Ag & Env Sci Poster 20:

Adaptation of the PET detector ring for a brain-imaging insert in the 3 tesla MRI machine

A. Spirou[1], A. Badia[1], C. Bauer[2], N. Nair[2], A. Stolin[3], J. Lewis[4], J. Brefczynski-Lewis[4], R. Raylman[3], and S. Majewski[3]

[1]Center for Neuroscience SURI program, [2]Center for Neuroscience, [3]Radiology, and [4]Physiology and Pharmacology, West Virginia University, Morgantown, WV 26506

This project's ultimate goal is to create a PET detector ring insert for placement within a 3 Tesla MRI machine. The focus of the project will be to study, design, and implement the means to minimize the electromagnetic interference between the PET ring insert and the substantial magnetic field within the MRI machine during dual modality brain imaging. Additionally, the project will define the optimal mode of imaging for this hybrid system- either simultaneous or sequential PET and MR imaging. The final demonstration of the selected mode of imaging will be performed using a set of brain phantoms and the S/N characteristics will be recorded. This dual modality imaging system will possess a host of clinical and research benefits by combining the strong molecular imaging capabilities of PET with the high-resolution anatomical images of MR. One of the first anticipated applications of the system (among others) is the dual PET/MR brain imaging of Alzheimer's patients.

Agricultural and Environmental Sciences Category

Ag & Env Sci Poster 21:

Fatty acid composition of adipose tissue of mice fed yeast, fish, or algae oil containing diets

Danielle Empson, John Ketz, Mary Roavich, and Kimberly Barnes

Davis College, West Virginia University, Morgantown WV 26506

Omega-3 fatty acids are known to improve heart health, lower cholesterol, improve depression, and provide various other health effects. Most Americans consume inadequate quantities of omega-3 fatty acids. Therefore, dietary supplements are sometimes taken to receive health benefits, but some sources of omega-3 fatty acids are more effective than others. Mice were fed equal amounts of the primary omega-3 fatty acids, docosahexanoic acid (DHA) and eicosapentanoic acid (EPA), using different controlled diets of soy oil (which lacks omega-3s), fish oil (high in DHA and EPA), yeast oil (high in EPA), algae oil (high in DHA), or a combination of yeast and algae oil. Total fatty acid composition of the adipose tissue of each mouse were collected and analyzed for differences in composition. Mice fed each of the omega-3 diets showed significant variation in fatty acid composition compared to the soy oil fed mice. Significant variation between diets was also found. Differences may provide insight into how the different oils are absorbed and used.

Physical Sciences and Engineering Category

Phys Sci & Eng Index

Physical Sciences and Engineering Category

Poster 16: *Electrostatically enhanced fluidized beds in microgravity*. **Miranda Straub** and John Kuhlman.

Poster 17: *Room-temperature linewidths and energies of resonances in GaAs quantum well*s. **Olivia Pavlic**, Brian Wilmer, Clayton Petroski, and Alan Bristow.

Poster 18: *Performance of direct carbon fuel cells using bio-derived fuels*. **Anna McClung**, John Zondlo, and Borja Cantero-Tubilla.

Poster 19: *Different mathematical descriptions of rotating black holes*. **Scott Ferris** and Richard Treat.

Poster 20: *Kinetics of IMS sampling with gunpowder and clandestine lab related materials*. **Joshuah Usilton**, Marriah Ellington, and Suzanne Bell.

Poster 21: *Photodegradation of Methylene Blue by $NaInO_2$*. **Craig Tenney** and James Lewis.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 1:

Drug delivery vehicles: effects of polyethylene glycol attachment on elastin-like Protein coacervation temperature

Tyler Holliday[1], Lauren Gioia[2], and Robin Hissam[2]

[1]Department of Biology and [2]Department of Chemical Engineering, West Virginia University, Morgantown, WV 26506

Elastin is a protein known for its strength, stability, and elasticity in the connective tissues of the skin, lungs, and arterioles. When heated, elastin-like polypeptides functionalized with polyethylene glycol (PEG) coacervate into vesicles and have potential to serve as drug delivery vehicles. By altering protein and salt concentrations as well as the molecular weight and shape of PEG, the temperature of coacervation (T_c) can be manipulated. This property can provide specificity to these potential drug delivery vehicles when dispensing their contents at certain sites within the body. In this study, we focused on the effects of the shape of the PEG molecules on T_c by comparing a PEG molecule with the coupling site on the terminus versus a PEG molecule with the coupling site within the molecule. By monitoring the coacervation by UV-Vis spectroscopy, results showed that the center coupled PEG/ELP4+ molecules coacervate at lower temperatures than the linear PEG/ELP4+ molecules. Additionally, the size of vesicle structures resulting from coacervation was characterized by light scattering and scanning electron microscopy.

Phys Sci & Eng Poster 2:

Exploration of XRD and SEM techniques for the analysis of $Ca_3Co_4O_9$ and β-FeO(OH)

Laura E. Carpenter, Xueyan Song, and Maria Alejandra Torres Arango

Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, West Virginia 26506-6045

Thermoelectric oxides like $Ca_3Co_4O_9$ present a means of producing power from the waste heat emitted by power plants, vehicles, and other machinery. Oxides are promising p-type thermoelectric materials because they are stable at high temperatures. However, their conversion energy efficiency must be improved to ensure that thermoelectric devices produce adequate power for power generation applications. Enhancing the energy conversion efficiency can be accomplished by increasing the electrical conductance, decreasing the thermal conductance, and increasing the temperature gradient. In this study SEM and XRD techniques were explored for analyzing $Ca_3Co_4O_9$, a thermoelectric oxide, as well as β-FeO(OH). The XRD results indicated that $Ca_3Co_4O_9$ pellets require a scan speed of 16 sec/step while β-FeO(OH) powder requires a scan speed of 38 sec/step for distinguishable peaks. The SEM results indicated that the β-FeO(OH) powder must have a conductive coating and be mounted on a silicon wafer in order to get clear images without charging effects. The SEM images of β-FeO(OH) revealed that the particles were roughly 500 nm with a narrow particle size distribution and a needle-like shape.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 3:

Gunshot residue signal decay and back-extraction analysis using thermal desorption ion mobility spectrometry

Marriah CG Ellington, Joshuah M Usilton, and Suzanne Bell

Forensic and Investigative Science Department, West Virginia University, Morgantown, WV 26506

Thermal desorption ion mobility spectrometry (IMS) is primarily used as a field device for detecting narcotics and explosives. It has great potential for analysis of organic gunshot residue (OGSR), an often-ignored source of evidence from propellant combustion. The focus was to develop a hand-swabbing method in which one swab could be interrogated using IMS, back-extracted, then analyzed using gas chromatography-mass spectrometry (GC-MS). First, each thermal desorption cycle loss was quantitated. Upon repetitive IMS scanning, methamphetamine, nitroglycerin, ephedrine, diphenylamine, and single-based gunshot standards were found to decay following second order kinetics. GSR field samples from a firing range were similarly scanned, and distinctive IMS patterns were discovered. An isopropanol method was created to collect a hand sample databank from the general populace; these were used to recognize background peaks, detect transfer or remnant GSR, and develop IMS signal-to-noise ratios. Further firing range GSR swabs run one time in IMS, back-extracted with methanol, then analyzed with GC-MS determined sample recyclability. This research displays the versatile applications of IMS and its adaptability to a variety of substances.

Phys Sci & Eng Poster 4:

Sensitive metal (II) ion determination with resonance raman method

Lucas A. Bracero[1,2], Zhi Yu[1], Lei Chen[1], Wei Song[1], Xu Wang[1], and Bing Zhao[1]

[1]State Key Laboratory of Supramolecular Structure and Materials, Jilin University, Changchun 130012, P. R. China and [2]C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV 26506

In the research we completed, a new proposal for the quantitative evaluation of divalent metal ions (M^{2+}) was developed; we accomplished this by a competitive resonance Raman (RR)-based method. Upon excitation with light of the appropriate wavelengths (532nm and 633nm), a strong electric field was generated that couples with the resonance of the complex (zincon-M^{2+}), increasing the character signals of these complexes, resulting in sensitive detection. The zincon did not give a signal at 633nm so the 532nm results are of more significance. Decreasing the metal (II) ions concentration led to a decrease in the formation of the zincon-M^{2+} complex, which led to the transformation of the Raman information. As a result, by using the proposed RR-based method, we found the liner calibration curves of Cu^{2+} and Ni^{2+}, showing potential in quantitative evaluation of an unknown sample. Cu^{2+} and Ni^{2+} were tested at both wavelengths while Co^{2+} was only tested using the 633nm laser. The abundant fingerprint information showed that RR can lead to successful analysis of blended solutions, containing two ions: Cu^{2+} and Ni^{2+}.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 5:

Synthesis of novel supramolecular gels based on halogen-bonding or di-sulfide bonds

Matthew Brooks[1,2], Libin Zang[1], Hongxing Shang[1], and Shimei Jiang[1]

[1]State Key Laboratory of Supramolecular Structure and Materials, Jilin University, Changchun, 130012, P. R. China and [2]Davis College of Agriculture, Natural Resources and Design, West Virginia University, Morgantown, WV 26506

Low-molecular-weight gels have attracted much attention because they consist of non-covalent bonds and form reversible, clear, simple, and easily synthesized gels. Our research focus was creating two new gelators, based on di-sulfide and halogen bonds respectively. To achieve this we are synthesizing compounds using cholesterol or three-alkoxy benzamide derivatives, due to their ability to self-assemble, and linking them with either di-sulfide or halogen bonds. The first gel will expand known gelator N,N-dibenzoyl-L-cystine to form gels in organic solvents. The second gel is based upon halogen bonding, where the halogen acts as a Lewis acid and forms a weak interaction with the Lewis base in a non-covalent fashion. This has never been done in a gel before to the best of our knowledge. Due to limited time, we focused on the synthesis of molecules to be used in the formation of gels. We successfully synthesized N,N-dibenzoyl-L-cystine and the Lewis-base half of the halogen-bonding gel. The significance of this study is that, if successful, we will have developed a novel way to form gels using halogen-bonding as well as expanded the versatility of N,N-dibenzoyl-L-cystine.

Phys Sci & Eng Poster 6:

Heterogeneous reaction of hydroxyl radicals with cellulose and cellulose surrogate

Chelsey Kirby, Juddha Thapa, and Fabien Goulay

C. Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV 26505

There has been a steady increase in the amount of research involved with biomass materials, such as cellulose and corn starch and especially about how to produce fuels from their thermal conversion. The chemistry associated with this conversion involves very complex reaction schemes including large organic molecules and gas phase radicals. The optimization of fuel production from biomass requires a better understanding of the chemistry between cellulose and gas phase radicals. We have studied the reaction between hydroxyl radicals and cellulose in order to determine the reaction mechanism. Hodroxyl radicals are generated by placing hydrogen peroxide under a 254 nm light for approximately five hours. In presence of cellulose we predict that the formed radicals will abstract a hydrogen at the C2 position of cellulose. In order to test our theory further we used a surrogate compound of cellulose, methyl beta-D-glucopyranoside (b-MPG) and also reacted it with hydroxyl radicals. Once we obtain the results from the solid state and liquid state NMR we are hoping to understand the reaction mechanism in the gas phase between cellulose and its monomer b-MPG.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 7:

Pulsar science: arecibo 327 MHz drift scan processing

Nathan A. Tehrani, Tessa M. Maynard, and Maura A. McLaughlin

Department of Physics, Eberly College of Arts and Sciences, West Virginia University, Morgantown, WV 26506

Pulsars are the extremely dense remnants of stellar cores that have survived supernova explosions. As they rotate, they emit pulses of radiation. For the past nine years, WVU astronomers have conducted a drift scan using the 305-meter radio telescope at the Arecibo Observatory. This project is part of an effort to process the radio data that was collected, in order to find new pulsars and to test hypotheses about previously known pulsars. Software was developed and used to isolate pieces of radio data for individual pulsars and pulsar candidates. This isolated data were processed by folding the data at the pulsars' period, in order to reveal the flux densities, or luminosities, of the known pulsars at the survey frequency of 327 MHz. It is hypothesized that the flux densities at 327 MHz will match those predicted by a model based on the known flux densities at 1400 MHz. The results of this experiment will test the model on which the hypothesis is based and calibrate our survey sensitivity.

Phys Sci & Eng Poster 8:

Engineering gradient hydrogels to determine optimal elasticity for cell adhesion

Joshua C. Morgan and Yong Yang

Department of Chemical Engineering, Benjamin M. Statler College of Engineering and Mineral Resources, West Virginia University, Morgantown, WV 26506

Hydrogels are water-swollen polymers with novel physical properties that make them excellent scaffolds for studying cellular differentiation, migration, and adhesion. Cell adhesion is a function of many physical properties, specifically elasticity, of living tissues or synthetic systems. In this study, we found through qualitative observation that elasticity increases as the ratio of polyethylene glycol (PEG) to water in the composition of a hydrogel increases. We designed a microfluidic gradient generator that can produce a hydrogel of gradient elasticity, corresponding to a gradient of PEG concentration. Two streams, water and PEG, are injected into and flow longitudinally through the device with dividers providing restricted diffusion, producing the gradient hydrogel. Atomic force microscopy will be employed to verify the elasticity gradient on the hydrogel. This hydrogel will be used to study cell migration in attempt to find the optimal elasticity for adhesion of normal cells as compared to that of cancerous cells. Ultimately, this gradient hydrogel will be employed as a separation device to isolate cancerous cells from a population so that they may be studied further.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 9:

Deprotection of triazole group under acidic conditions

James Jirak, Qiaoyi Wang, and Xiaodong Shi

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

Currently, a major synthesis of substituted traizoles is through the copper catalyzed "click" method, in which an azide is reacted with an alkyne. This can only be done with a primary substituted azide reacting with terminal alkyne. Good leaving groups, such as pivolate, are chosen as the substituent on the azide in the reaction, which can be easily taken off the triazole after synthesis is finished. This, however, can only be done under basic conditions. In our work, we are developing a method of de-protecting a benzyl-substituted triazole using acidic conditions. Hence, the ability to protect and de-protect under acidic conditions would extend the application of triazoles in the field of total synthesis. Here, a series of strong acids, such as trifluoroacetic acid and hydrobromic acid, and using them to try and promote an SN1 de-protection of the triazole after an SN2 protection.

Phys Sci & Eng Poster 10:

Fused-based segmentation method for the tracking of human lung epithelial cells

Michael Martin, Xiang Li, Yuxin Liu, and Thirmachos Bourlai

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

The investigation of the nano-toxicity effects on lung epithelial cells requires the design and the development of an efficient algorithm, capable of tracking the morphological changes of such cells during long-term cell culturing. Many techniques have been developed that have been proven to be efficient in automated cell tracking and the identification of mitotic events to generate entire cell paths through time-laps images. However, these methods often do not allow for the accurate measurement of morphological features due to complications in identifying cells. We propose a new approach that can efficiently perform lung epithelial cell region segmentation and tracking. Our proposed fused-based method utilizes the cell segmentation methods that show to have great accuracy in tracking algorithms in congruence with a post processing segmentation method once the cells have been identified and successfully tracked to better facilitate the analysis of cell morphological changes.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 11:

Creation and characterization of bismuth selenide crystals for use as topological insulators

Robert Chastain, Sercan Babakiray, and David Lederman

Department of Physics, West Virginia University, Morgantown, WV 26506-6045

Creation and characterization of devices that are too small to be seen with even the most powerful optical microscope remain primary obstacles in the advancement of nano-scale devices. One method that will effectively support creation of a material will typically only be useful as a rough guide in creation of even a similar material. It has been found that fabrication of thin film bismuth selenide (Bi_2Se_3) can be efficiently created utilizing Molecular Beam Epitaxy (MBE) in which bismuth and selenium are raised to a high temperature in an ultra-high vacuum to facilitate a high rate of sublimation and subsequent condensation on a relatively cool sapphire substrate selected for its crystal geometry. Characterization is achieved using various methods that rely on the crystalline nature of the material, mainly reflection high-energy electron diffraction (RHEED) imaging during crystal growth and x-ray diffraction (XRD) after completion. Bismuth selenide is useful as a topological insulators. Topological insulators are of interest due to there unique electrical conductance and spin-orbit coupling among other interesting physical properties.

Phys Sci & Eng Poster 12:

Microfluidic gradient device for cell migration study

Matthew W. Logan[1], Hanyuan Zhang[2], and Yuxin Liu[2]

[1]Wheeling Jesuit University, 316 Washington Avenue, Wheeling, WV 26003 and [2]Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV 26506

The controlled and reproducible generation of a spatiotemporally complicated chemoattractant gradient is required to study the breadth of mechanisms at play in cellular chemotaxis. The objective of the project is to develop a microfluidic gradient device for studying cell migration with a precisely controlled gradient of chemical stimuli to the cultured cells. The method using microfluidic devises offer more suitable environment than traditional biological systems, such as Boyden chamber, agarose or collagen gels, Zigmond chamber, and Dunn chamber. Microfabrication and microfluidic techniques are experimentally simple while also providing a relatively inexpensive alternative to conventional methods. This technique of fabrication also allows for quick generation of multiple copies of a device and allows for modifications from one prototype to another to happen in a short period of time. In addition, the device offers excellent optical resolution and in situ monitors the cell responses to the gradient with flexible channel designs and fast gradient generation.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 13:

Modeling the electron density of the Milky Way using pulsar dispersion measures

Adam Collins and Duncan Lorimer

Department of Physics, West Virginia University, Morgantown, WV 26506

Understanding the distribution of free electrons in the interstellar medium of our Galaxy has applications in a number of areas of astrophysics. Because of turbulent processes within the Galactic disc, it cannot be assumed to be uniform throughout. Previous models have been made of the electron density of the Galaxy using pulsar dispersion measures collected up until the late 90's. Since then, many new pulsars have been discovered that are able to be used to a get a more accurate model. Using these latest data, we are developing a number of different models with the goal of creating an up-to-date and unbiased picture of the free-electron distribution.

Phys Sci & Eng Poster 14:

X-ray and non-linear optical characterization of $NiFe_2O_4$ heterostructures

Joseph E. Reynolds III[1], Srinivas Polisetty[1], Robbyn Trappen[1], Jinling Zhou[1], Mikel B. Holcomb[1], and Matthew A. Marcus[2]

[1]*Department of Physics, West Virginia University, Morgantown, WV 26506-6315 and* [2]*Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, CA 94720*

The study of surface and interface physics has been of great interest in magnetic materials. A thin film (~90nm) of ferrimagnetic material, $NiFe_2O_4$, was deposited on two substrates, Al_2O_3 and $Pt/TiO_2/SiO_2/Si$. $NiFe_2O_4$ displays drastically different magnetic properties based on the substrate. The two samples were characterized using a high-powered femtosecond laser to induce second harmonic generation (SHG) with a 45° angle of incidence at various temperatures. Preliminary results obtained from angular plots of the SHG displayed multiple lobe patterns in both samples. Since centrosymmetric materials, like $NiFe_2O_4$, should produce no second harmonic, the signal obtained is likely from the surface or interface. The results also showed that some lobes were radically different between samples, while some polarizations of the incident and reflected light created nearly identical patterns. Further study will be conducted on substrate monolayers in order to understand the origin of the signal. In addition, the nickel and iron k-edge of the multilayer sample were analyzed using x-ray fluorescence and TIY/TEY in order to determine the interactions between the bulk and surface of these materials.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 15:

Lasting effects of Nicaraguan agrarian reform: mapping of the Las Tunas social movement

Maria J. Panaccione, Bradley Wilson, and Derek Stemple

Department of Geology & Geography, West Virginia University, Morgantown, WV 26505

A series of agrarian reforms after the 1979 Nicaraguan revolution led to changes in ownership of land, a dependence on export economy, and change in worker/land ownership dynamics. In 2002, the Las Tunas movement led by starving farmers and families asking for work and land access arose in the region of Matagalpa. We hypothesize that the participants of this movement originated from farms and working communities that were affected by the coffee crisis of the early 2000s. For this study we mapped the protest settlements and participating communities associated with the Las Tunas movement using the GIS software ArcMap. Results indicated that there was spatial correlation between properties owned by the failed corporation AGRESAMI and the larger protest settlements. In addition, we found the protest settlements were placed in areas of high visibility such as the Pan-American Highway and at intersections of roads leading to large farms. Results signify the widespread impact of loosely regulated agrarian reform, risky economic practices, and volatile markets on the Nicaraguan peasant and worker population.

Phys Sci & Eng Poster 16:

Electrostatically enhanced fluidized beds in microgravity

Miranda N. Straub and John M. Kuhlman

Benjamin M. Statler College of Engineering and Mineral Resources, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506-6024

Fluidized beds are used in many applications including chemical and biochemical reaction processes and other mass and heat transfer applications. In order to properly fluidize a bed of particles on Earth, a force to counter particle drag (in this case the gravitational force) must be present. Under microgravity or zero-gravity conditions, this gravitational force is absent which results in particles accumulating at the top of the bed and hindering proper fluidization. The purpose of this experiment is to fluidize a bed of small particles in microgravity using electrostatics. Specifically, point electrodes were inserted into the bed to charge small glass particles while two large copper plates were used to create an electric field on the bed. It was predicted that an appropriate magnitude of an electric field would create a net Coulomb force on the bed to replace the magnitude of the gravitational force, allowing for proper fluidization. While video evidence of some experimental testing looks promising, numerical data is currently being analyzed for additional results and further understanding of fluidization in microgravity.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 17:

Room-temperature linewidths and energies of resonances in GaAs quantum wells

O. M. Pavlic, B. L. Wilmer, C. M. Petroski, and A. D. Bristow

Department of Physics, West Virginia University, Morgantown, WV, 26506-6315

Optical resonances in GaAs quantum wells have been extensively explored at low temperatures, where the dephasing time can be several tens of picoseconds and thus make them an ideal model system for studying coherent many-body interactions [1]. Quantum-well-based devices, such as lasers and LEDs, are likely to operate at higher temperatures, where dephasing is significantly faster and spectral linewidths are broader. Here we perform optical spectroscopy on GaAs quantum wells at room temperature to examine the linewidths and energies. From linear spectroscopy, we observe band-edge Coulomb enhancement in the substrate and weak exciton correlations in the quantum wells. Determination of the oscillator strengths allow for prediction of the strength of transient four-wave mixing measurements.

Phys Sci & Eng Poster 18:

Performance of direct carbon fuel cells using bio-derived fuels

Anna K. McClung, John Zondlo, and Borja Cantero-Tubilla

Department of Chemical Engineering, West Virginia University, Morgantown, WV, 26506

A direct carbon fuel cell (DCFC) is an electrochemical device that uses solid carbon as fuel to convert chemical energy into electricity through direct electrochemical oxidation. As DCFCs are in the preliminary stage of development, optimum design and operating conditions are undecided. In this research, a solid electrolyte DCFC incorporating a molten liquid anode and a solid ceramic electrolyte/cathode assembly is being investigated. A planar electrolyte structure made of yttrium stabilized zirconia (YSZ) with the cathode layers printed on one side and the anode layers printed on the other is employed. Various carbon sources are being investigated. The carbon sources are different types of biomass including hardwood, corn stover, yellow poplar, and switchgrass with different pretreatments. Previous research has shown highest performing cells used a combined anode structure of dense and porous gadolinium doped ceria (GDC), and a eutectic mixture of lithium and potassium carbonates with 80 wt% carbon when using carbon black as the carbon source. To determine the cell performance, open circuit voltage, maximum current and power densities, and electrochemical impedance were recorded.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 19:

Different mathematical descriptions of rotating black holes

Scott R. Ferris and Richard Treat

Physics Department, West Virginia University, Morgantown, WV 26506

Einstein's Field Equation in 4 dimensions relates the curvature and metric of certain classes of manifolds that are physically the dynamic background for massive bodies to interact. These massive bodies may be charged and/or rotating much like Earth or the Sun. All three properties (mass, angular momentum, charge) distort the curvature of the 4 dimensional manifolds (aka spacetime) in a unique way. In 1963, Kerr was the first to solve Einstein's equation for a rotating mass which differs drastically from a non-rotating mass; known as the Kerr Metric. Rotation introduces an axisymmetric topology which restricts the properties of possible geodesics on the multiple surfaces that describe different regions around and within the rotating black hole. Most mathematical representations of the Kerr metric are cumbersome in calculation and lead to odd physical interpretations when crossing between null separated regions. More recently spinor representations have proven to be less cumbersome and more physically enlightening. Mathematical consideration is given to a spacetime with three temporal and one spatial dimension(s) and possible physical interpretations are given.

Phys Sci & Eng Poster 20:

Kinetics of IMS sampling with gunpowder and clandestine lab related materials

Joshuah Usilton, Marriah Ellington, and Suzanne Bell

Forensic and Investigative Science Department, West Virginia University, Morgantown, WV 26506

The focus of this research is the analysis of multiple components of gunpowder, via nitroglycerin testing along with gunshot single standard (GSS), and key chemicals of clandestine labs, such as methamphetamine and ephedrine. In this study, we used the ion mobility spectroscopy (IMS) machine to analyze swabs that had standards of varying concentrations applied to them. Our goal was to determine the maximum number of times a sample could be tested and to see what if any pattern the decreasing peak size would follow. After extensive testing the area of the peaks on the IMS were found to follow a Kinetic model of the second order, meaning a rapid initial decrease in area followed by a relatively steady, slow decline, similar to an exponential curve if it was mirrored. These kinetic models act as foundational knowledge for the application of this examination in real life scenarios, which shall be covered by my associate’s research on hand swabs.

Physical Sciences and Engineering Category

Phys Sci & Eng Poster 21:

Photodegradation of methylene blue by $NaInO_2$

Craig Michael Tenney and James Lewis

Department of Physics, White Hall, Box 6315, West Virginia University, Morgantown, WV 26506-6315

Delafossite is a mineral that has the general formula ABO_2. A is usually a positive atom similar to platinum, copper, or silver. B is another positive atom similar to gallium, indium, or a transition metal. O_2 is the symbol for two oxygen atoms. Delafossites are commonly found at the base of copper deposits in oxidized regions. One very important property of these delafossites is their photoconductivity, the ability to absorb light and excite a valence electron, a resting electron, to the conduction band, an excited state, leaving behind a hole. This electron-hole pair is then able to conduct a current. To test their photoconductivity, dyes can be used to see how much photodegradation, or break up of the dye, the delafossite causes. I will be looking into the photodegradation of methylene blue dye by the delafossite sodium/indium/oxide ($NaInO_2$). In a previous experiment, the addition of iron (Fe) into $NaInO_2$ showed that the photodegradation is not as effective. By using computers, I will be simulating the replacement of 5%-10% of In in $NaInO_2$ with Fe. This will show the effect Fe has on the band structure of $NaInO_2$ and how effective the photodegradation will be and the mechanisms behind it.

Nanosciences Category

Nanosciences Index

Nanosciences Category

Poster 16: *Non adiabatic molecular dynamics of cis-Stilbene photoisomerization*. James Lewis, Barry Haycock, and **Logan Shamberger**.

Poster 17: *Patterning of graphene on thin insulating films using halogen based plasma etching*. **Jason Miles** and Charter Stinespring.

Poster 18: *Characterization of (6,5) enriched single walled carbon nanotube ultrathin films*. **Lawrence Jacob**, Sai Gunturu, Thomas Searles, Clayton Simien and Daneesh Simien.

Poster 19: *Development of 3D photonic crystals at West Virginia University*. **Alicia Harmon**, Anand Kadiyala, and Jeremy Dawson.

Poster 20: *Making science accessible using the novint falcon*. Marjorie Darrah, Aniketa Shinde, and **Mohamad Kassar**.

Poster 21: *Real-time analysis of the effects of sub-therapeutic concentrations of digitoxin on non-small cell lung cancer*. **Surya Manivannan**, Reem Eldawud, and Cerasela Zoica Dinu.

Nanosciences Category

Nano Sci Poster 1:

Self-assembly of stable protein 1 nanotubes using cadmium telluride quantum dot linkers

Kailey A. Imlay, Lu Miao, and Junqiu Liu

State Key Laboratory of Supramolecular Structure and Materials, College of Chemistry Jilin University

Stable Protein 1 (SP1) is a 108 amino acid polypeptide with a molecular weight of 12.4 kDa. It is a stress related protein with a high thermostability (T_m) of 107°C that naturally exists as a hydrophilic dodecomer protein ring. Due to its highly stable nature and ring structure, SP1 protein is an attractive naturally occurring molecule for use in self-assembled nanotubes. The objective of this study is to synthesize nanotubes out of SP1 protein rings. Due to electrostatic forces, negatively charged SP1 protein rings can be connected in series using positively charged cadmium telluride quantum dot (QD) linkers. The ratio of SP1 protein to quantum dots that is most conducive to spontaneous self-assembly is unknown. This study carries out the screening of differing ratios of SP1 and quantum dots in order to discover what ratio should be used in SP1 protein nanotube assembly. Results display continuing advancement toward this correct ratio. Such nanotubes will have applications in biological research for use in fluorescence resonance energy transfer (FRET) as well as applications in biosensing devices and construction of biomaterials.

Nano Sci Poster 2:

Microvascular reactivity after titanium dioxide, zinc oxide, or multi-walled carbon nanomaterial exposure

Katie S. Spears, Phoebe A. Stapleton[1,2], Valerie C. Minarchick[1,2], Travis L. Knuckles[1,2], and Timothy R. Nurkiewicz[1,2]

[1]Center for Cardiovascular and Respiratory Sciences, West Virginia University School of Medicine, Morgantown, West Virginia, USA; [2]Department of Physiology and Pharmacology, West Virginia University School of Medicine, Morgantown, West Virginia, USA

Nanotechnology holds tremendous promise in the realms of medicine, engineering, and manufacturing; however, nanomaterial toxicity is poorly understood. If the full potential of nanotechnology is to be realized, its toxicity must first be determined. We studied arterioles because they are critical in pressure regulation and chemical signaling. The purposes of this study were to determine if nanomaterials alter arteriolar function and identify underlying mechanisms. Intravital microscopy was performed on the spinotrapezius muscle of anesthetized Sprague-Dawley rats. Arteriolar reactivity under the normal superfusate was determined by topical applications of acetylcholine (ACh, 10^{-4}M) and phenylephrine (PE, 10^{-4}M). Varying concentrations (10, 100, 1000 µg/µL) of titanium dioxide, zinc oxide, and multi-walled carbon nanotubes were superfused, and arteriolar reactivity was reassessed. Maximum arteriolar diameter was determined (adenosine, $1.0e^{-2}$M) at the conclusion of each experiment. Nanomaterial co-incubation differentially affected resting diameter. Furthermore, responsiveness to ACh and PE was augmented. These results suggest that nanomaterials may be able to alter basal homeostatic and reactive microvascular mechanisms, and this could be due to nanomaterial chemistry and/or geometry.

Nanosciences Category

Nano Sci Poster 3:

Systematic evolution of ligands for prostate cancer cells and bromacil by exponential enrichment

Cyrus J. Hajiran[1], Ryan M. Williams[2], and Letha J. Sooter[2]

[1]Department of Biology and [2]Department of Basic Pharmaceutical Sciences, West Virginia University, Morgantown, WV 26506

Using *in vitro* selection, also known as the Systematic Evolution of Ligands by Exponential Enrichment (SELEX), these experiments are designed to select for molecular recognition elements (MREs) that bind with high affinities and specificities to their corresponding targets. Prostate cancer is the most-diagnosed carcinoma among men in the United States. An antibody fragment specific for the prostate cancer cell line LNCaP will be isolated. Previous work used the SELEX process to amplify yeast-displayed antibody fragments that bind to the LNCaP cell line but not benign prostate cells. Similarities among sequenced antibody fragments have been determined. Identified MREs will be combined with nanoparticles and used for targeted drug delivery to, or non-invasive imaging of, prostate tumors. Bromacil is an herbicide that negatively impacts ecosystems and has the potential to be a human carcinogen. A single-stranded DNA MRE selective for the herbicide has been isolated using the SELEX process. Binding assays have determined a dissociation constant in the 1-20nM range. This MRE will be incorporated into a sensing device to detect Bromacil in contaminated waterways.

Nano Sci Poster 4:

The effect of aryl hydrazines on the formation of Z-DNA

Terri L. Griffith, Kelly A. Lyons, Nissa M. Thomsen, and Peter M. Gannett

Department of Basic Pharmaceutical Sciences, West Virginia University, Morgantown, WV 26506

Z-DNA is the only left handed form of DNA. It forms transiently upon interacting with Z-DNA binding proteins (ZBP) such as DAI. It is known that some carcinogens such as aryl hydrazines form DNA adducts that render DNA more prone to Z-DNA formation and perhaps gene deregulation. DAI has two separate DNA binding domains: Zα and Zβ. The Zα domain is thought to bind solely to Z-DNA while Zβ binds to B-DNA and converts it to the Z form. Here the effect of the Zβ binding domain on both unmodified and 8-phenyl guanine CG decamers $d((CGCGCGCGCG))_2$ will be monitored for the B/Z transition using circular dichroism (CD). It is hypothesized that the Zβ binding domain will be more Z prone when interacting with 8-phenyl guanine CG decamers then with unmodified. The B/Z transition is expected to occur much faster in the presence of 8-phenyl guanine CG decamers then in the presence of the unmodified CG decamers which will be determined by a time scale measurement using the CD.

Nanosciences Category

Nano Sci Poster 5:

The FLIPPED classroom and differentiated instruction in high school science: STEM research as an educational tool

Sherry Finkel, Elizabeth Yates, and Justin Legleiter

Department of Chemistry, West Virginia University, Morgantown, WV, 26506

Traditional high school classroom protocol includes in-class lectures proceeded by homework. Many students suffer a distinct disadvantage when completing homework in their home environments. This lesson plan implements a "FLIPPED" classroom model in which lectures are assigned as homework and assignments are performed in the class with the teacher's guidance. The style allows for differentiated instruction and discovery-style learning in an environment where the teacher acts as a mentor to his/her students. We have created a video documenting the newly developed assay to determine the extent of ABeta protein interactions with lipid vesicles. The ABeta protein forms plaques in the brains of patients with Alzheimer's disease. The ABeta/lipid interaction assay is a colorimetric response of a polydiacetylene polymer imbedded in lipid vesicles, which is monitored over 24 hours. The students will watch the video as homework, and perform Excel manipulations in class. The data file will reflect actual data from the assay. The three corresponding student assignments vary in difficulty to accommodate a differentiated classroom.

Nano Sci Poster 6:

In vitro selection of molecular recognition elements for detection of exotoxin and prostate cancer

Ann M. Jackson, Ryan M. Williams, and Letha J. Sooter

WVU Department of Basic Pharmaceutical Sciences, PO Box 9530, Morgantown, WV 26506

Molecular Recognition elements (MREs) are molecules that have specific and high binding affinity to their target. *In vitro* selection is used to isolate and obtain binding MREs. Exotoxin is bacteria secreted by the pathogen *Pseudomonas aerguinosa*. Exotoxin can inhibit protein synthesis in mammalian cells and is involved in infectious diseases that are harmful to humans such as food poisoning. MREs specific for exotoxin have been selected. We are determining which MRE has the highest affinity for exotoxin. We have narrowed the binding constant to the low-nanomolar range. This will be used to identify foods with Exotoxin. Prostate cancer is the most-diagnosed cancer among men in the U.S. Present treatment for cancer is non-specific and detection methods have high false-positive rates. MREs specific for malignant prostate cancer cells have been obtained. We are determining the sequence of binding MREs. From these, one will be chosen for further binding studies. Discovery of MREs with binding affinity for the targets of interest can be used as biosensors for detecting exotoxin in foods and detecting and treating prostate cancer.

Nanosciences Category

Nano Sci Poster 7:

The phosphodiesterase (PDE) inhibitor papaverine reduces ethanol intake in mice

Arpan V. Prabhu, Paula Davis, and Han-Ting Zhang

Department of Behavioral Medicine and Psychiatry, West Virginia University Health Sciences Center, 1 Medical Center Drive, Morgantown, WV 26506-9137, USA

Alcohol dependence kills 79,000 people and costs $223 billion yearly in the U.S. Cyclic AMP (cAMP) and cyclic GMP (cGMP) protein kinase signaling has been implicated in ethanol consumption regulation in mice. Of the 11 known phosphodiesterases (PDEs), PDE4 and PDE10 catalyze cAMP hydrolysis and increase intracellular cAMP/cGMP levels in the basal ganglia circuit. Basal ganglia circuit dysfunction is implicated in alcoholism and CNS disorders including Alzheimer's. PDE4 and PDE10 are emerging as targets to regulate alcohol abuse. This study examined whether PDE4 and PDE10 regulate ethanol intake in mice. The two-bottle choice and drink-in-dark paradigms assessed intake of ethanol, sucrose, and quinine in C57BL/6J mice treated with papaverine, a PDE10 inhibitor that also inhibits PDE4. Blood ethanol concentrations and locomotor tests were conducted. Papaverine at doses of 10 and 30 mg/kg reduced ethanol consumption, although at lower doses (0.3-3.0 mg/kg) papaverine did not significantly affect ethanol consumption. The results indicate that PDE4 and PDE10 may be novel targets for drugs that reduce ethanol intake; their inhibitors may be a potential pharmacotherapy for alcohol dependence.

Nano Sci Poster 8:

Establishment and characterization of bioluminescent biofilms using Staphylococcus aureus and Klebsiella pneumonia

Steven McHenry, William Artrip, Jabeen Noore, and Bigyun Li

West Virginia University, Department of Orthopaedics, Morgantown, WV 26505-604

Biofilms, colonies of bacteria enclosed in an extracellular matrix, are a rising threat in the medical field. Biofilms exhibit high resistant qualities against common antibiotics and are known to be upwards of 1000 times more resistant that planktonic bacteria. Medical implants are common targets of biofilms which may cause post operation complications for patients. Due to the rising threat of biofilms new forms of treatment are needed. The current study characterized several strains of bacteria that are commonly involved in implant infection, four of which were bioluminescent. Biofilms were formed on stainless steel discs as well as polystyrene substrates. The formation of biofilms was characterized using several approaches. Scanning electron microscopy was used to examine biofilm morphology, IVIS imaging to determine the bioluminescence at different time periods during biofilm formation, and colony forming unit count to quantify the bacterial colonies within the biofilms. A relationship between the bioluminescence intensity and bacterial colonies was established and may guide future biofilm studies using bioluminescent bacteria.

Nanosciences Category

Nano Sci Poster 9:

Fabrication of 3-D hierarchical microstructure via spin coating and UV-photolithography

Justin D. Harvey, Huaizhong Shen, and Bai Yang

State Key Laboratory of Supramolecular Structure and Materials, Jilin University, 2699 Qianjin Avenue, Changchun, 130012, P.R. China

Many aspects of organismal development rely heavily on multi-layered structures. These structures provide the necessary framework to influence cellular structure and promote differentiation. This research focuses on the fabrication of a multi-layer microstructure with potential applications in tissue engineering, cell cultivation, and the production of metamaterials. Similar structures have been developed that exhibit precise control of *in vitro* cell proliferation. In this work, a multi-layer structure containing 5.5 bilayers was obtained by spin-coating alternate layers of polyvinyl alcohol (PVA) and positive photoresist. The delicate process of photolithography and development is currently being applied under various UV exposure times and NaOH concentrations. Also, different polymers are being explored to increase the stability of the product. Once successful, this structure may be pursued on the nanoscale for metamaterial development, which will involve the processes of deep UV etching or Electron beam lithography. Perhaps this structure's unique design will provide new opportunities for research expansion in biology and physics.

Nano Sci Poster 10:

Chiral organic cation encapsulated polyoxometalates in asymmetric catalysis

Deanna Boyer[1], Yizhan Wang[2], and Lixin Wu[2]

[1]*Department of Chemical Engineering, West Virginia University, Morgantown, West Virginia 26506 and* [2]*State Key Laboratory of Supramolecular Structure and Materials, College of Chemistry, Jilin University, Changchun 130012, China*

Asymmetric catalysis has been found useful in efficiently obtaining enatiopure chemicals for both research and industry. This research focuses on using chiral organic cation encapsulated polyoxometalates (POMs) as catalysts in the asymmetric oxidation of various sulfides and improving the enantioselectivity of the products. A disadvantage of using POMs as catalysts in asymmetric catalysis involves their multiple catalytic sites, which makes it difficult for all the sites to be chirally activated. This causes a decrease in asymmetric products. Multiple POMs were used to oxidize various sulfide substrates, and the enantiomeric excess was determined for each reaction. Sandwich-type POMs were found to yield higher enatioselectivity over Keggin-type POMs, due to the higher ratio of chirally activated catalytic sites to surface area. The enantioselectivity was further improved by kinetic resolution. Optimal reaction conditions were found to be at 0°C, using chloroform as the solvent for the catalyst. Hydrogen peroxide was determined to be the best oxidizing agent. The cation-encapsulated sandwich-type POM complex, $C_{16}H_{20}N/WZnMn_2(ZnW_9O_{34})_2$, exhibited an asymmetric catalytic activity for the oxidation of a sulfide with 32% enantiomeric excess.

Nanosciences Category

Nano Sci Poster 11:

The effects of buckminsterfullerene on P450 enzyme metabolism

Wesley D. Tish, Chris D. Bostick, and Peter M. Gannett

Robert C. Byrd Health Sciences Center School of Pharmacy, West Virginia University, Morgantown, WV 26506-9530

Novel technologies are frequently employed in a variety of new ways, and as technological advances increase at a rapid pace we need to ensure that new technologies are not causing unintended harm. Recently, nanoparticles have emerged as a technology with great potential benefit to the medical community as a drug delivery vehicle. In this study we analyzed how a nanoparticle known as buckminsterfullerene (C60) interacts with Cytochrome P450 enzymes, a family of enzymes which metabolize more than 75% of all pharmaceuticals. We incubated C60 particles with Cytochrome P450 CYP2C9 and measured how the metabolism process was affected by the presence of the C60. Our preliminary results indicate that C60 particles inhibit metabolism in CYP2C9 enzymes. Molecular modeling studies suggest the effect may be allosteric in nature. Therefore this research is significant because using C60 as a drug delivery mechanism will also inhibit metabolism and produce altered pharmacokinetics which will have to be accounted for in drug dosing.

Nano Sci Poster 12:

Nanosensors for defect identification using flexible, transparent, deformation responsive single walled carbon nanotube meshes

Joe Feeney, Sai Gunturu, and Daneesh Simien

Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506

Extensive research has shown that thin films of single walled carbon nanotubes (SWCNTs) exhibit significant changes in conductivity when subjected to mechanical deformations. These properties have allowed for the production of flexible electronics including strain sensors. Much of today's infrastructure would benefit from a diagnostic, more sensitive strain sensor able to detect and communicate cracks and material failures at the initial stages of generation. In this study, the use of homogeneous lengths of SWCNTs was investigated for optimal strain sensing sensitivity aiming to improve upon previously developed sensors made from random lengths of SWCNTs. UV-Vis-NIR Spectroscopy and Atomic Force Microscopy were used in conjunction to characterize homogeneous length sorted nanotube solutions. Transferred to a polydimethylsiloxane (PDMS) testing surface, the devices were capable of detecting crack origin and crack propagation in the PDMS at the nanoscale. The SWCNT strain sensors will replace traditional strain sensors and be utilized as more sensitive structural health monitoring systems.

Nanosciences Category

Nano Sci Poster 13:

Mechanism for plasmonic rnhancement of metal/semiconductor core/shell nanoparticles

Joeseph M. Bright[1], Jiangtian Li[1], Scott K. Cushing[2], and Nianqiang Wu[1]

[1]Department of Mechanical and Aerospace Engineering and [2]Department of Physics, West Virginia University, Morgantown, WV 26506

Photocatalysis, the process of using sunlight to drive chemical reactions, has been a widely researched topic for uses such as water splitting. However, several materials for photocatalysis have large energy band gaps that limit the possible usable light to ultraviolet light. Nanoparticles with a metallic core and semiconductor shell have shown improved photocatalytic ability in comparison to semiconductor nanoparticles alone due to the effects of light excited electron oscillations called surface plasmon resonance. However, the mechanism behind this enhancement is claimed to be a direct electron transfer (DET) from the gold core into the semiconductor shell. The role, if any, of resonant energy transfer (RET) in enhancing photocatalytic ability found in metal/semiconductor core/shell nanoparticles has not been widely explored. To test whether RET has an impact on the photocatalytic enhancement, four samples of core/shell nanoparticles were synthesized (Au/TiO_2, Ag/TiO_2, $Au/SiO_2/TiO_2$, and $Ag/SiO_2/TiO_2$). The use of SiO_2 was to provide a barrier against DET while allowing RET. Photocatalysis and transient absorption measurements show that RET contributes to the plasmonic enhancement found in metal/semiconductor core/shell nanoparticles.

Nano Sci Poster 14:

Fluidic characterization of a thermally responsive nanogel in a microfluidic chip

Laura D. Casto, Xingwei Wu, Tyler A. Davis, and Lisa A. Holland

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

Microfluidic devices have been utilized to search for evidence of life in outerspace, as portable devices to advance medical tests, and to miniaturize analytical instrumentation. Miniaturized chemical analyses in a chip still require methods to direct fluid flow. Strategies to introduce fluid valves in a chip increase the complexity of the device, which in turn increases the cost and failure rate. A nanogel has been used as a separation medium for microscale separations because of the dramatic viscosity changes with temperature. Because of this unique characteristic, we utilize these nanogels as smart materials to steer fluids in a microfluidic chip. Below 24ºC the nanogels have a viscosity similar to water, while the nanogels become gel-like between 24ºC and 29ºC. Utilizing smart materials to steer fluids in chips is an alternative to integrating mechanical valves. Understanding all qualities of the nanogel is necessary for this application. Where ambient temperature is 21ºC the nanogel behaves as a non-Newtonian fluid obeying the power-law, so effects of ambient temperature on non-Newtonian behavior can be observed by raising surrounding temperature.

Nanosciences Category

Nano Sci Poster 15:

Detection of trace amounts of atrazine by surface enhanced raman spectroscopy

Allison M. Rice, Peng Zheng, and Nianqiang Wu

Department of Mechanical and Aerospace Engineering, WV Nano Initiative, West Virginia University, Morgantown, WV 26506-6045

The ability to be able to detect toxic substances in trace amounts is very important in keeping the environment safe. Atrazine is commonly used around the world as a pesticide, however, it can remain in the soil and groundwater, which leads to contamination problems. Exposure to Atrazine can cause birth defects in humans, such as the reproductive and developmental abnormalities in rodents. The maximum amount that can be in drinking water is 3.0 ppb, so the need to be able to detect low quantities is extremely essential. Two effective methods have been proposed for the detection of trace amounts of Atrazine based on surface enhanced Raman spectroscopy (SERS), which are a silver triangle nanoarray and a gold nanoparticle based SERS for Atrazine detection. These methods are in the process of being verified because the ability to have significant detection depends on many details. It is important to be able to establish if the Atrazine is attached to the anti-atrazine antibody for proper detection or if it is better to attach the Atrazine directly to get a Raman spectrum.

Nano Sci Poster 16:

Non adiabatic molecular dynamics of *cis*-Stilbene photoisomerization

James P. Lewis, Barry Haycock, and Logan Shamberger

Department of Physics, West Virginia University, Morgantown, WV 26506

The photoisomerization of *cis*-stilbene continues to be of interest as an example of a light driven reaction and a basis upon which to build molecular switches and motors. We modeled this reaction with FIREBALL, an *ab initio* tight binding molecular dynamics package, utilizing recent developments in non-adiabatic coupling to model electron transitions during the course of the simulation. The simulations show that key features of this reaction, the vibrationally hot product and the conical intersection of energy levels, were reproduced by our calculations. In order to obtain meaningful information about this process an ensemble of simulations were done with a variety of initial conditions. Preliminary analysis of the results shows that there is a relation between the ethylene dihedral angle at the time of the transition and the final conformation. They also show that the individual isomerization events tend to take 190 fs rather than the experimentally reported bulk decay time of 330 fs. By our ensemble approach we are able to determine these nanoscale properties of the reaction that are difficult to probe experimentally.

Nanosciences Category

Nano Sci Poster 17:

Patterning of graphene on thin insulating films using halogen based plasma etching

Jason R. Miles and Charter D. Stinespring

Department of Chemical Engineering, West Virginia University, Morgantown, WV 26505-6045

Graphene exhibits high electron and hole mobility, making it a promising material to be used in nanoelectronic circuit applications. Our research has previously shown that graphene films, with thicknesses of one to four layers, can be formed on 6H-SiC by CF4 based inductively coupled plasma-reactive ion etching (ICP-RIE) followed by thermal annealing of the modified surface. The focus of this study was the patterning of graphene onto the 6H-SiC surface. Gold was deposited for the alignment marks due to its resistance to the plasma etch. ICP-RIE was then performed to form the graphene. This involved the use of standard lithography procedures along with plasma etching to create the desired pattern on the substrate. These surfaces were then analyzed by X-ray photoelectron spectroscopy and Raman spectroscopy to determine their composition. Contacts were deposited onto the patterned graphene so that electrical measurements could be made. This research represents the first steps toward patterning large area graphene-on-insulator films and the fabrication of electronic devices on these films.

Nano Sci Poster 18:

Characterization of (6,5) enriched single walled carbon nanotube ultrathin films

Lawrence Jacob[1,a], Sai Gunturu[2], Thomas A. Searles[1], Clayton Simien[2] and Daneesh Simien[2]

[1]Deparment of Physics, Morehouse College, Atlanta, GA 30314
[a] WVNano NSF REU, West Virginia University
[2]Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506

The robust, yet flexible characteristics of single walled carbon nanotubes (SWCNTs) make them ideal for almost any application. The optical and electrical properties of carbon nanotubes make SWCNT thin films the foundation of future biosensors and photovoltaics. In this study, we investigated the conductivity and near to far infrared absorbance of (6,5) SWNTs ultrathin films (thickness < 20nm). The single walled carbon nanotubes embedded in the films were enriched by a repetitive Density Gradient Ultracentrifugation process. The thickness of each film was then measured using White Light Ellipsometry and Atomic Force Microscopy. Other optical properties of the ultrathin films were studied using UV Vis NIR Spectroscopy and Fourier Transform Infrared Spectroscopy. Furthermore, we investigated the electrical characterization of the thin films using an Agilent Impedance Analyzer. Overall, the goal of this research is to facilitate the use of (6,5) SWNT thin films for higher performance sensors and devices.

Nanosciences Category

Nano Sci Poster 19:

Development of 3D photonic crystals at West Virginia University

Alicia Harmon, Anand Kadiyala, and Jeremy Dawson

Lane Department at West Virginia University's Benjamin M. Statler College of Engineering and Mineral Resources

In the modern world, the verification of individual uniqueness within an interconnected global population is becoming increasingly more difficult to verify due to the increasing amount of online electronic information stored for each person. A negative consequence of globalization is the spread of knowledge and resources that are devoted to fool or "spoof" current biometric technologies. For example, an individual person can purchase a set of fingerprints fingerprint gloves which can fool most basic security systems. Fingerprint sensors employing photonic crystals can allow for detection of these fake fingerprints. 3D photonic crystals, nanoscale periodic lattice structure that have unique properties with the propagation of light, have been found to be a good method of solving problems related to spoofing in biometric fingerprint technologies. These 3D PhC films are fabricated via self-assembly of nanospheres in a 3D lattice which is followed by filling the voids between the spheres with alkylmethacrylate. Dissolving the spheres forms an inverse opal structure. The most feasible lattice structure is the self-assembly of spheres in a face centered cubic arrangement with spheres having a 186 nanometer radius. This presentation will outline the theoretical modeling and design of such a 3D lattice, and initial steps at fabrication.

Nano Sci Poster 20:

Making science accessible using the novint falcon

Marjorie Darrah[1], Aniketa Shinde[2], and Mohamad Kassar[3]

[1]Department of Mathematics, [2]Department of Physics,[3]Lane Department of Electrical Engineering and Computer Science, West Virginia University, Morgantown, WV 26506

Making Science Accessible is a project designed to bring new technologies to middle schools. These technologies are optimized to educate students who have low vision or are blind but are also useful for sighted students. The Novint Falcon is a low cost device that provides three-dimensional (3D) force feedback. It is a controller with the ability to move left, right, forwards, and backwards, up, and down. When the computer's cursor interacts with objects on the screen, the Falcon will give a response based on programming. The Falcon can be used to interact with 3D environments and give the ability to sense texture, shape, dimension, weight, and dynamics. The device can be helpful in studying a topic like nanoscience. It is hard to teach concepts related to this scale due to its innate intangibility. We cannot interact with atoms and molecules directly. Thus, we need tools to help explain phenomena at the nanometer level. Through our programming and implementation of the Falcon as a tool, we aim to allow students to explore the field of nanoscience and make the subject easier to learn. Applications will be developed using Visual C++ and OpenGL. Currently, we have one application in the testing phase, and one in development.

Nanosciences Category

Nano Sci Poster 21:

Real-time analysis of the effects of sub-therapeutic concentrations of digitoxin on non-small cell lung cancer

Surya Manivannan, Reem Eldawud, and Cerasela Zoica Dinu

Department of Chemical Engineering, West Virginia University, Morgantown, WV 26505

Digitoxin is a cardioglycoside with anti-proliferative effects on lung cancer cells. Studies have shown that digitoxin's anticancer activity may be associated with its ability to induce apoptosis by inhibiting the Na^+-K^+-ATPase pump. However, the anticancer mechanisms at clinical concentrations are still subject to debate. Herein, a non-invasive technique called Electric Cell Substrate Impedance Sensing (ECIS) was used to assess behavior and cytotoxicity of non-small cell lung cancer (NCl-H460) to therapeutically relevant digitoxin concentrations. ECIS allowed characterization in real-time of the impedances changes of cells immobilized onto gold electrodes. Further correlation with changes in cellular morphology and attachment, as well as cell-cell interactions allowed identification of the key cytotoxic players. ECIS evaluation was complemented by apoptosis, viability assays, and confocal microscopy. Results showed that exposure to digitoxin affects cell adhesion and cell-cell interactions in a dose-dependent manner. This study is the first to focus on determining effects of digitoxin on barrier function, cell adhesion, and cell membrane integrity in NCI-H460 cancer cells, and opens new perspectives for research on digitoxin's anticancer mechanism in lung cancer.