

# COURI

College of Science  
Office of Undergraduate Research Initiatives

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THE UNIVERSITY OF TEXAS AT EL PASO

## Book of Abstracts

Lourdes E. Echevoyen & Alina Nuñez, Editors

# 1<sup>st</sup> Annual COURI Symposium

**Showcasing Emerging Researchers at the  
Forefront of Science**

**Saturday, April 16<sup>th</sup>, 2011**

**Undergraduate Learning Center**





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# **COURI's Mission**

The College Office of Undergraduate Research Initiatives is committed to enriching the overall undergraduate experience of undergraduate students interested in Science and Mathematics by facilitating, enhancing and showcasing their research training. COURI will ensure that College of Science graduates are able to compete effectively for the best graduate and professional programs in the world and are prepared to join a 21st century Science, Technology, Engineering and Mathematics workforce that is globally engaged.





*COLLEGE OFFICE OF UNDERGRADUATE RESEARCH INITIATIVES*

**1<sup>st</sup> Annual COURI Symposium:  
Showcasing Emerging Researchers at the Forefront of Science**

Saturday April 16, 2011, 12:30 pm -5:30 pm  
Undergraduate Learning Center - UTEP Campus

**PROGRAM AGENDA**

**Welcome, Introductions and Opening Remarks**

UGLC Auditorium 106 – 12:30 pm

Lourdes Echegoyen  
Director  
College Office of Undergraduate Research  
Initiatives

Anny Morrobel-Sosa  
Dean  
College of Science

**Careers in Science Forum & Panel Discussion**

UGLC Auditorium 106 – 12:45-2:15

**Keynote Speakers**

Lou Valdez, MSM  
Associate Commissioner for International Programs  
U.S. Food and Drug Administration

Stefan Zollner, Ph.D.  
Department Head  
Department of Physics, New Mexico State University

**Undergraduate Student Poster Presentations**

UGLC First Floor Hall 2:30 pm – 4:00 pm

**Reception and Awards Banquet**

El Paso Natural Gas Conference Center, 4:00 pm

**Closing Remarks**

El Paso Natural Gas Conference Center, 5:00 pm

Diana Natalicio  
President  
The University of Texas at El Paso





**Careers in Science Forum**  
**Featured Speakers**



# Mary Lou “Lou” Valdez, MSM

Associate Commissioner  
International Programs  
U.S. Food and Drug Administration



- UTEP Graduate - 1986 B.S. Biology major, Chemistry minor
- Master of Science in Management - University of Maryland University College
- Joined the U.S. Department of Health and Human Services (HHS) in 1991
- Majority of Government career in the HHS office of Global Health Affairs (1994-2009), with last position as Deputy Director
- In 2009, became Associate Commissioner for International Programs, U.S. Food and Drug Administration

Mary Lou “Lou” Valdez is working hard to ensure your safety—with every bite you eat, every pill you take, every medical device you use, and every time you powder your nose.

Named associate commissioner for international programs with the U.S. Food and Drug Administration (FDA) in 2009, Valdez, a 2010 College of Science Gold Nugget Award recipient, helps oversee the agency that regulates food, drugs, cosmetics and medical devices imported from overseas.

“The FDA is looking ahead on how to manage the increasing challenges and complexities of the global landscape,” she said. “Products that Americans consume are increasingly imported from other countries, developed and developing countries alike.”

Valdez has worked for the U.S. Department of Health and Human Services (HHS) since 1991. Prior to her recent appointment with the FDA, she was deputy director of the HHS Office of Global Health Affairs.

She now helps lead the FDA’s efforts to position the agency globally. The goal of those efforts is to expand the agency’s capacity to oversee imported food and medical products, and to increase standards for safety and manufacturing quality in other parts of the world, thereby ensuring that Americans are protected as they continue to benefit from the advantages of a global marketplace.

Valdez credits her UTEP experience—she earned a bachelor’s in biological sciences in 1986—with helping her meet the challenges faced by the FDA.

“My strong orientation toward public service was influenced by my time at UTEP,” she said.



## Stefan Zollner, Ph.D.

Department Head  
Department of Physics  
New Mexico State University



Since July 2010, Dr. Stefan Zollner is the Department Head of the Physics Department at New Mexico State University in Las Cruces, NM. Dr. Zollner's research is centered on the optical properties of materials (especially spectroscopic ellipsometry) and applications for measurements in the semiconductor industry.

Previously, Dr. Zollner was an integration engineer in the 32nm SOI process technology development group at the IBM Alliance in East Fishkill, NY, located in the Hudson Valley about an hour north of New York City. He was responsible for the formation of silicide Ohmic contacts, which connect the nanoscale silicon transistors to copper wires and the outside world.

After receiving his M.S. and Ph.D. degrees in physics at Universität Stuttgart (Germany) in 1987 and 1991, with a year as a Fulbright exchange student at ASU, and a year as a post doc at the IBM Research lab in Yorktown Heights, NY, he joined the physics faculty at Iowa State University in Ames, IA. He left Iowa in 1997 and joined the Semiconductor Products Sector of Motorola (now Freescale Semiconductor, Inc.), where he has held several positions as a manager and individual contributor in Mesa, AZ, Tempe, AZ, Austin, TX, and East Fishkill, NY. Initially an expert in spectroscopic ellipsometry and x-ray diffraction (thin-film measurement techniques used in the production of modern CMOS, bipolar, and III/V transistors), he has spent the last four years in CMOS process integration. In late 2008, he moved from Freescale to IBM.

Dr. Zollner is a Fellow of the American Physical Society and APS Councilor representing the Forum on Industrial and Applied Physics (FIAP). He was a co-organizer of the 24th International Conference on the Physics of Semiconductors held in Flagstaff, AZ, in 2004. He is an author of over 140 peer-reviewed publications and over 110 conference presentations. He has given more than 50 invited talks at conferences and institutions. He is the 2008 recipient of the SRC Mahboob Khan Outstanding Mentor award, recognizing his contributions as an SRC industrial liaison to training students in electrical engineering and for technology transfer from universities to the microelectronics industry.



# Acknowledgements

Diana Natalicio, President  
Howard C. Daudistel, Senior Executive Vice-President  
Junius Gonzalez, Provost and Vice-President for Academic Affairs  
Roberto A. Osegueda, Vice-President for Research  
Cynthia Vizcaino Villa, Vice-President for Business Affairs

Anny Morrobel-Sosa, Dean, College of Science  
Stephen B. Aley, Associate Dean, College of Science  
Nancy C. Marcus, Associate Dean, College of Science

Vanessa Loughheed, Professor, Department of Biological Sciences  
Victoria S. Gutierrez, Director, Institutional Advancement

Sigma Xi UTEP Chapter  
SACNAS El Paso del Norte Student Chapter

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Roxanne C. Giron  
Jose L. Muñoz  
Vikas Haridas Mudavakkat  
Oscar E. Prieto

Special thanks to all faculty members that mentored students presenting at this symposium for their dedication to the mission of undergraduate research





# **Biomedical Sciences**



3-15-2011

# Leptin Protects Dendritic Cells from Chemically-Induced Cell Death

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# Leptin Protects Dendritic Cells from Chemically-Induced Cell Death

Yadira Arellano<sup>^</sup>, Jeff Sivils and Kristine Garza\*

*Department of Biological Sciences, University of Texas at El Paso*

Leptin is a pleiotropic adipokine that exerts its physiological effects by binding to its receptor, which is expressed in many immune cells including T cells, macrophages, and dendritic cells. Multidrug resistance-associated protein (MRP) is a transmembrane transporter commonly associated with cancer cells conferring resistance to chemotherapy. The purpose of this study is to determine if leptin supersedes the cytotoxic death signal in dendritic cells. We further hypothesize that the mechanism underlying leptin protection is a result of over expression of MRPs. To address this question, we examined the effect of leptin on monocytes treated with cytotoxic drugs *in vitro*. Bone marrow-derived dendritic cells (BM-DCs) and JAWSII were treated with camptothecin (CPT), plumbagin (PB8) or doxorubicin (Doxo) in the presence or absence of leptin. CPT, Doxo and PB8 are anticancer drugs that inhibit topoisomerase I, topoisomerase II and induce free radical formation respectively. Cell line viability was assessed via a colorimetric assay. Induction of cell death was measured by annexin V/propidium iodine staining. BMDCs generated from DB mice with a nonfunctional leptin receptor were used in response to camptothecin, leptin or a combination. The data demonstrates that leptin inhibits cell death upon treatment with cytotoxic agents.

3-29-2011

# Validation of Methionine Aminopeptidase-1 as a Potential Chemotherapeutic Target for *Leishmania major*

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## Recommended Citation

Calzada<sup>^</sup>, Elizabeth; Serna, Carylinda; Vasquez, Miguel A.; Olaleye, Omonike; and Maldonado<sup>\*</sup>, Rosa, "Validation of Methionine Aminopeptidase-1 as a Potential Chemotherapeutic Target for *Leishmania major*" (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 7.

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# Validation of Methionine Aminopeptidase-1 as a Potential Chemotherapeutic Target for *Leishmania major*

Elizabeth Calzada<sup>^</sup>, Carylinda Serna, Miguel A. Vasquez, Omonike Olaleye<sup>1</sup>, Rosa A. Maldonado\*

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Cutaneous leishmaniasis is a vector-borne disease caused by *Leishmania major* affecting millions of people throughout the world. It is an emerging concern in the United States due to military establishments in endemic countries. Treatment for the disease is highly toxic and the lack of vaccines emphasizes on the need for alternative drug treatments. Aminopeptidase inhibitors have shown promising results against malaria and tuberculosis. Methionine aminopeptidase-1 (MetAP1) catalyzes the removal of the N-terminal methionine residue from peptides and proteins. The human MetAP1 has low similarity with the *Leishmania* enzyme making it a potential chemotherapeutic target. The MetAP1 gene was amplified through PCR from *L. major* genomic DNA and cloned into the expression vector pRSET A. The expression and purification of the recombinant enzyme was performed and the biochemical characterization of the enzyme is underway. Transgenic promastigotes of *L. major* (Friedlin clone V1) expressing firefly luciferase were used to determine the antiparasitic activity of putative MetAP1 inhibitors. Eight compounds were tested and three of them showed great anti-leishmanial activity at 0.78 μM for 72 hr. with 5-6% survival (IC<sub>50</sub> = 125 nM). The enzymatic assay using the recombinant enzyme will be developed to determine the inhibitors' specificity.

3-16-2011

# Screening of Metal-Based Azole Derivatives Antiparasitic Activity on Trypanosoma cruzi and Leishmania major

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# Screening of Metal-Based Azole Derivatives Antiparasitic Activity on *Trypanosoma cruzi* and *Leishmania major*

Teresia A. Carreon<sup>^</sup>, Linda Herrera, Miguel Vasquez, Roberto A. Sanchez-Delgado, Rosa A. Maldonado\*

*Department of Biological Sciences, University of Texas at El Paso. Chemistry Department, Brooklyn College.*

The trypanosomatids *Leishmania major* and *Trypanosoma cruzi* are parasites that affect millions of people worldwide. Leishmaniasis is naturally transmitted via sandflies while *T. cruzi* is transmitted by kissing bugs. Due to immigration and deployment to endemic regions, lack of screening in blood banks and climatic changes these neglected diseases have become a growing health concern in the United States. The lack of vaccines to prevent/treat the diseases and the toxicity of current treatments supports the need for new drug treatments. Azole compounds inhibit the sterol synthesis pathway of these parasites, which has been validated as a drug target. *T. cruzi* epimastigote forms were analyzed using alamarBlue®. A luciferase assay was used with transgenic promastigotes (Friedlin clone V1) expressing firefly luciferase for *L. major*. The parasites were incubated 72 hr with the drugs. The most potent trypanocidal compounds were AM163 and AM161 showing 86% and 78% mortality at 468 nM; followed by AM160 and AM103 with 91% mortality at 937 nM. For *L. major* the most efficient derivatives were AM162 and AM161, with 84% and 80% mortality using 243 nM. To determine the clearance of the parasite in infected cells, *in vitro* infectivity experiments using high content imaging are planned. The goal of the project is to find new treatments for Chagas' disease and leishmaniasis.

3-24-2011

# Cloning and Expression of Methionine Aminopeptidase-1 from *Trypanosoma cruzi*

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# Cloning and Expression of Methionine Aminopeptidase-1 from *Trypanosoma cruzi*

Adan J. Lara<sup>^</sup>, Miguel Vasquez, Rosa A. Maldonado\*

*Border Biomedical Research Center, Department of Biological Sciences,  
University of Texas at El Paso, El Paso, TX 79968*

*Trypanosoma cruzi* affects millions of people worldwide. This unicellular eukaryotic organism is the causative agent of Chagas' disease. This blood-borne pathogen is transmitted to humans by the hemophagous triatomine or kissing bug. The high toxicity of existing treatments and the lack of vaccines clearly demonstrate the demand for new drugs to treat this parasitosis. We propose to target *T. cruzi* Methionine Aminopeptidase (TcMetAP1). This enzyme catalyzes the removal of the N-terminal amino acid residues from peptides and proteins. Recent studies have shown promising results of MetAP1 inhibitors against malaria. We, therefore, hypothesize that specific inhibitors of the parasitic MetAP1 will clear the infection produced by this parasite. Using information from the *T. cruzi* genome project, primers were designed and the MetAP1 gene was amplified by PCR from genomic DNA. Subsequently it was cloned into the expression vectors pRSET A and pPink. The TcMetAP1 expressed in *E. coli* was insoluble; to overcome this problem we are currently working on the expression and purification of the recombinant enzyme in yeast *Pichia* expression system. The goal of this project is to develop a specific enzymatic assay to perform high-throughput screening of a small molecule inhibitors library.

3-16-2011

## Expression and Purification of Recombinant LEDGF/p75

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### Recommended Citation

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# Expression and Purification of Recombinant LEDGF/p75

Ivonne Reyes<sup>^</sup>, Daniel Reyes, Manuel Llano\*

*Department of Biological Sciences, University of Texas at El Paso*

HIV infection requires the integration of a DNA copy of the viral genome into the host chromosome. The cellular protein LEDGF/p75 has an essential role in this process. Different cellular proteins interact with LEDGF/p75, but the significance of these interactions for HIV infection is unknown. To further characterize these protein interactions, we will use recombinant LEDGF/p75 wild type (WT) and mutants. LEDGF/p75 WT was PCR amplified and cloned N-terminally fused to glutathione S-transferase (GST). This expression plasmid was later used to generate deletion mutants targeting different LEDGF/p75 functional domains. These constructs were transformed into *E. coli* Rosetta. Optimal conditions for the expression, extraction and affinity purification of GST fusion proteins were experimentally determined. The main problem that we have encountered during the production of the recombinant LEDGF/p75 is protein stability. Conditions of the culture or the induction minimally improved the stability of the fusion proteins. We have observed that the C-terminal region of the protein is more stable than the full-length protein or the N-terminal region. Nevertheless we have been able to purify GST-LEDGF/p75 WT although a GST fused degradation product is still present in our preparation. We will attempt further purification of the recombinant protein through gel filtration.

4-4-2011

## Dopamine's Role in Ethanol Induced Behavioral Disinhibition

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# Dopamine's Role in Ethanol Induced Behavioral Disinhibition

Erick Benjamin Saldes<sup>^</sup> and Kyung-An Han\*

*Department of Biological Sciences, University of Texas at El Paso*

Ethanol is commonly associated with disinhibited motor and sexual behaviors in humans. Dopamine and serotonin are implicated in these processes since they regulate reward, motivation, aggression, movement control, and sexual behavior. Disinhibited behavior such as impulsivity (loss of impulse control) is also related to addiction. The major goal of this study is to identify the role of dopamine in disinhibited behavior using the genetic model system, *Drosophila melanogaster*. For this task we developed a novel apparatus called Flypub. It is a plastic chamber with a clear top for recording and monitoring fly behavior before, during, and after ethanol exposure. Sedation time is measured in order to monitor the fly's capacity to tolerate the ethanol after repetitive exposures. Male flies do not court other male flies; however, they show a significant increase in courtship activity under the influence of ethanol, representing "cognitive disinhibition". The studies are in progress using diverse fly mutants to identify specific subsets of neurons in the brain mediating the ethanol induced courtship disinhibition. Immunohistochemistry studies are also used to identify the molecules associated with disinhibited courtship behavior. The progress in this study will be presented.

**Chemistry**  
**&**  
**Biochemistry**



4-4-2011

# DNA-inks for 3-D Printing: DNA Composites for the Rapid Prototyping of Scaffold in Bioengineering Applications

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# DNA-inks for 3-D Printing: DNA Composites for the Rapid Prototyping of Scaffold in Bioengineering Applications

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Rapid-prototyping has become an incredible technique that manufactures three-dimensional objects with intricate complexity down to 8 $\mu$ m of resolution. We are developing materials that can be used by rapid-prototyping instruments to make scaffolds for bioengineering applications. Our molecular design involves the polymerization of a (vinylbenzyl)trimethylammonium chloride and DNA solution. Upon UV illumination, the composite polymerizes and forms DNA-hybrid materials. The end result becomes a ductile transparent material with a thin cross-section. The synthesis, characterization and application of rapid prototyping will be described. Scanning Electron Microscopy (SEM), Light Scattering Detector (LDS), Nuclear Magnetic Resonance (NMR), and Infrared Spectroscopy indicate the structure, characteristics, and the presence of the DNA-polymer. Analyses that test the mechanical properties of the scaffolds will be discussed.

3-15-2011

# Initialization of Structural Proteomic Studies of the Giant Marine Virus CroV

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# Initialization of Structural Proteomic Studies of the Giant Marine Virus CroV

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The existence of cellular genes in viruses such as the nucleocytoplasmic large DNA viruses (NCLDV) has led to not only the redefinition of the virus but also the mystery of the origin of these genes. *Cafeteria roenbergensis* virus (CroV) is a giant marine virus in the NCLDV clade. Information obtained from structural proteomics studies of CroV can be compared with known cellular counterparts, elucidating the evolutionary relationship between virus and cell in a three-dimensional structural aspect. CroV's major capsid protein gene (MCP) and five CroV genes, (CDS 84, 115, 143, 149, 152) including a photolyase and an oxidoreductase, have been chosen to be cloned, expressed, and crystallized to determine their atomic structures. Cloning will be accomplished using Invitrogen's Gateway System, which confers the advantage of accessibility to different expression systems. Proteins will be purified to high homogeneity via affinity chromatography for screening of crystallization conditions. Atomic structures will be determined through x-ray crystallography. CroV genes 84, 115, 143, 149, and 152 are in the cloning phase and the MCP gene is in protein expression trials. Comparisons to homologous proteins, functional analyses, and mutagenesis studies will follow to extend the proteomics study of CroV.

3-15-2011

# Metal Carbonyl Catalysts for the Transformation of Silicon Hydrides to Siloxanes in the Presence of DMF

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# Metal Carbonyl Catalysts for the Transformation of Silicon Hydrides to Siloxanes in the Presence of DMF

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It has recently been reported that, upon photochemical irradiation, tertiary silanes ( $R_3SiH$ ) react with DMF to form disiloxanes ( $R_3Si-O-SiR_3$ ) and  $Me_3N$ , using the transition metal alkyl complex  $(\eta^5-C_5H_5)Fe(CO)_2Me$  as a catalyst. Intermediates of the type  $R_3SiOCH_2NMe_2$  were proposed as the important first step via a hydrosilylation reaction but no evidence was obtained for this suggestion. By changing the catalyst to  $Mo(CO)_6$  we have now observed that not only do we form the expected disiloxanes, but for the first time have observed the suggested intermediates. We have synthesized such intermediates via an independent method and demonstrated that they can indeed further react with  $R_3SiH$  to form the disiloxane products.

3-16-2011

## Synthesis of Pyridine-Based Ligands as Potential Magnetic Liquid Crystals

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### Recommended Citation

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# Synthesis of Pyridine-Based Ligands as Potential Magnetic Liquid Crystals

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Ligands for the development of metallomesogens (metal-containing-liquid-crystals) have attracted attention due to potential applications in materials science such as optical devices, magnetic switches, and conductors. The attempts to synthesize bis(3-alkoxy) pyridine amines are presented. These structures are designed to exhibit liquid crystalline properties as metal complexes. Reaction conditions using potassium carbonate and potassium *tert*-butoxide as bases under Ullmann-type conditions in various solvents (aromatic and non-aromatic), between -78 °C to 160 °C, have been unsuccessful. It is imperative to understand the electronic effects of the *meta*-substituted pyridine precursors to further develop the copper-catalyzed conditions of these types of molecules.

3-15-2011

# Biochemical Characterization and X-ray Crystallography of a Lysozyme Encoded by *Pseudomonas aeruginosa* Bacteriophage SN

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Herrera<sup>^</sup>, Nadia; Filchikov, Maxim V.; Hildenbrand, Zacariah L.; Molugu, Sudheer K.; Mesyanzhinov, Vadim V.; Miroshnikov, Konstantin A.; and Bernal\*, Ricardo A., "Biochemical Characterization and X-ray Crystallography of a Lysozyme Encoded by *Pseudomonas aeruginosa* Bacteriophage SN" (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 11.  
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# Biochemical Characterization and X-ray Crystallography of a Lysozyme Encoded by *Pseudomonas aeruginosa* Bacteriophage SN

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Bacteriophage SN is a virulent phage that selectively infects the bacterium *Pseudomonas aeruginosa*. It was isolated from Lake Chernoe in Russia and it is related to the PB1-like species of the Myoviridae family. The DNA genome is composed of 66,391 base pairs, has 89 predicted open reading frames, and encodes more than 20 structural proteins. One of the open reading frames of this newly discovered bacteriophage has high sequence identity to other lysozyme and chitinase genes. It is therefore assumed that this protein encoded by bacteriophage SN is utilized for digestion of the host cell wall prior to injection of the nucleic acid into the host. Determining the high-resolution structure of the protein will aid in later determination of location within the intact phage. The gene of interest has been cloned into *E. coli* by PCR amplification and ligation into the PET30a vector. This protein expressed to high levels and the product has been purified to homogeneity. The protein demonstrated specific enzymatic activity by lysis of *Micrococcus luteus* cells in suspension as purity increased. Crystals of the protein currently diffract to 3.5 Å, the data gathered from optimized crystals will be used to determine the X-ray structure of the lysozyme.

3-17-2011

# Expression and Purification of a Redox-Sensitive Green Fluorescent Protein Fused with Anthrax Toxin Lethal Factor

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# Expression and Purification of a Redox-Sensitive Green Fluorescent Protein Fused with Anthrax Toxin Lethal Factor

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Pathogenicity of *Anthrax Bacillus* is induced by its exotoxin composed of protective antigen (PA) lethal factor (LF) and edema factor (EF) that together target mammalian cells. As previous studies have suggested, it is important to study the structure of the targeted receptor (ANTXR2) as there has been evidence showing that the disruption of the disulfide bonds present in the receptor ectodomain inhibits the PA-mediated LF translocation across the membranes of mammalian cells, suggesting that cellular redox potential plays an important role in the anthrax toxin action. Here, we have constructed a fusion-gene containing the Nterminal Lethal Factor and a redox-sensitive green fluorescent protein (roGFP) which will allow for tracking of the redox potential while anthrax toxin travels within the host cell. The LFN-roGFP gene was constructed by using over-lap PCR allowing for linkage of the genes with the incorporation of BamHI/NdeI restriction sites that will allow for subsequent insertion into a pet-15b vector.

4-13-2011

## Trypanosoma cruzi - Derived Sugar Epitopes - Synthesis and Immunology

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# *Trypanosoma cruzi*-Derived Sugar Epitopes – Synthesis and Immunology

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The protozoan parasite *Trypanosoma cruzi* is the causative agent of Chagas disease. As of today no effective vaccine has been developed for it. Certain developmental stages of *T. cruzi* express cell surface oligosaccharides with terminal alpha-galactosyl and rhamnosyl residues, which are believed to be highly immunogenic in humans. The exact structures and sizes of these epitopes are still unknown. Our quest is to shine light on the chemical structures of immunogenic alpha-Gal and alpha-Rha containing mono-, di-, and trisaccharides that are conjugated to a keyhole limpet hemocyanin (KLH) carrier protein through a combination of chemical synthesis and immunological studies. The compounds synthesized were screened for their ability to be recognized by Chagasic antibodies in an enzyme-linked immunosorbent assay (ELISA). The best recognized sugar-KLH conjugates were used to immunize alpha-1,3 Gal T-KO mice, which do not express cell surface proteins with terminal alpha-galactosides, and are therefore a suitable model for humans. We have successfully synthesized and conjugated a library of nine saccharides with terminal alpha-galactosyl or rhamnosyl moieties, which elicit various levels of antibody production in mice. Upon challenge of the immunized mice with lethal doses of live *T. cruzi*, prolonged survival was observed when compared to the control group. The work presented here has implications for the development of a carbohydrate-based vaccine for Chagas disease.

4-4-2011

## Toxicity of TiO<sub>2</sub> Nanoparticles in Cucumis Sativus

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# Toxicity of TiO<sub>2</sub> Nanoparticles in *Cucurbita pepo*

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Nanoparticles (NPs) have a wide range of applications in medicine, electronics, catalysis, cosmetics, and pharmaceuticals. TiO<sub>2</sub> NPs are very stable and can be transported and dispersed into aquatic environments. Several animal species have shown negative reaction to TiO<sub>2</sub> NPs. However, little is known about their toxicity on plants, specially their possibility to enter the food chain via the crops utilized or subsequent production steps. We have studied the possible genotoxic effects of TiO<sub>2</sub> NPs on cucumber (*Cucumis sativus*), a worldwide cultivated species that serves as food for insects and other animals in the food web. Seven-day old hydroponically grown cucumber plants were treated for 15 days with 21 nm TiO<sub>2</sub> NPs (Nippon Aerosil) dissolved in the Hoagland nutrient solution at concentrations of 500, 1000, 2000 and 4000 ppm. NPs suspensions were sonicated for 30 min in an ultrasonic homogenizer to avoid aggregation. Genomic DNA quantification was performed in root tips after seven days of treatment following standard DNA extraction procedures. Results showed that, compared to controls, plants treated at the highest TiO<sub>2</sub> NP concentrations (2000 and 4000 mg/L) had a decrease in genomic DNA.

3-16-2011

## Novel Approach to New Endohedral Fullerenes

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# Novel Approach to New Endohedral Fullerenes

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Since the discovery of  $C_{60}$  many different allotropes of carbon have been found, isolated and researched. Of particular interest, Ugarte et al. in 1992 first reported the observation of onion-like structures known as carbon nano onions (CNOs). They consist of concentric fullerene cages separated by the same distance as the layers of graphite. These carbon nanoparticles can be obtained from either arc discharge of graphite under water or by thermal annealing of nanodiamonds. Through the annealing process using the nanodiamonds, 6 to 8 layer onions can be obtained on average. It has been demonstrated that multi-walled nanotubes (MWNT) can be thinned and opened using supercritical water treatment. MWNT can also be stripped using 4000 psi pressure at 400 °C. An alternative method which has proven effective to cut nanotubes and to exfoliate graphite is treatment with concentrated acid solutions. Here, we used the oxidative method reported by Tour et al. to convert large CNOs to smaller sized CNOs (2-3 layers). Small CNOs have never been studied and characterized, therefore their isolation will provide new information on the properties of higher size fullerene cages. If we isolate these fullerenes, their functionalization, properties and electrochemistry can be further studied in detail.

3-16-2011

## Characterization of Promoter Specific Effects Displayed by Beta-Catenin and FKBP52 in the Regulation of AR

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Olivares<sup>^</sup>, Karen; Cox<sup>\*</sup>, Marc B.; and Storer, Cheryl, "Characterization of Promoter Specific Effects Displayed by Beta-Catenin and FKBP52 in the Regulation of AR" (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 35.  
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# Characterization of Promoter-Specific Effects Displayed by FKBP52 and $\beta$ -Catenin in the Regulation of AR Function

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*Department of Biological Sciences and  
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One of the most interesting topics in steroid hormone research is examining the influence of regulators of the steroid hormone signaling pathways. By identifying and understanding the relationship between these regulators on events of transcriptional regulation, receptor localization, and degradation events, we can target these regulators to enhance or decrease their influence on the steroid hormone receptors' activities within the cell. Increased transcription by the Androgen Receptor has been implicated in several prostate cancer studies. Two proteins in particular, FKBP52 and  $\beta$ -Catenin, are of interest to our group, to examine for potential interaction in signaling cascades promoting prostate cancer.  $\beta$ -Catenin's involvement in the Wnt signaling pathway appears to be important for understanding the development of prostate cancer, and increased levels of FKBP52 are implicated in prostate cancer.  $\beta$ -Catenin and FKBP52 appear to coactivate AR in a synergistic fashion when transfected into FKBP52 knockout MEFs. We have found that  $\beta$ -Catenin and FKBP52 synergize using the synthetic steroid hormone regulated MMTV promoter, but this synergism is maximized when the endogenous AR probasin promoter is used. The promoter specificity of this synergism suggests that  $\beta$ -Catenin and FKBP52 exert their effects on AR signaling at the transcriptional level. We wish to explore other endogenous AR promoter reporters, as well, and have a better understanding of the relationship between these proteins.

3-15-2011

## Method Development for the Analysis of DDT, DDD, and DDE in Cow Milk

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# Method Development for the Analysis of DDT, DDD, and DDE in Cow Milk

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Organochlorine Pesticides (OCs) are classified as persistent organic pollutants (POPs). They have been found to bioaccumulate in organisms over time. These chemicals tend to attach to fatty tissues in animals and humans, remaining for long periods of time. OCs may be responsible for a vast number of health conditions including neurological disorders, endocrine disruption, reproductive dysfunctions, and possible linkage to cancer. OCs such as DDT, DDE and DDD are banned, however, they have still been detected in environmental samples worldwide. The main objective of this study is to investigate the presence of DDT, DDE and DDD in cow milk using an innovated and environmental friendly technique, called Stir Bar Sorptive Extraction (SBSE). SBSE coupled with thermal desorption Gas Chromatography and Mass Spectroscopy will be applied in the analysis of OCs in milk samples.

3-16-2011

## Bis( N, N-diphenyl-3-pyridineamine) Tungsten Complex as Molecular Gyroscope

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# Bis(N,N-diphenyl-3-pyridinamine) Tungsten Complex as Molecular Gyroscope

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In recent years, the interest in molecular machines has increased based on inspiration from macroscopic machines, such as gyroscopes applied in racecar engines and arrays of gyroscopes in automatic pilot functions. The same concept has been taken down to the nanoscopic level as molecular machines in solution like bevel gears and turnstiles, but for application use they must be in the solid state. Gyroscope molecules can exhibit fast rotation and the aim is to design free rotation in the crystal lattice that maintains volume conserving motion. Bis(N,N-diphenyl-3-pyridinamine) tungsten complex was prepared by irradiation of tungsten hexacarbonyl in the presence of THF and the free ligand N,N-diphenyl-3-pyridinamine. It was partially characterized from preliminary data (Infrared spectroscopy, <sup>1</sup>H and <sup>13</sup>C NMR, and mass spectroscopy). The dipyridine and tripyridyl amines are currently being synthesized for formation of the di- and tri-rotor complexes. Similar ligands are being synthesized with a single pyridine and with two and three pyridyl groups.

3-16-2011

## Structural Study of mCRY2: A Circadian Rhythm Regulator

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# Structural Study of mCRY2: A Circadian Rhythm Regulator

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A circadian clock is a 24 hour biological rhythm that regulates physiological, psychological and behavioral processes in living organisms. Understanding the regulation mechanism of such circadian rhythms can have great impact in certain diseases such as sleeping disorders and cancers. There are many genes regulating circadian rhythms in different species. Cryptochromes (CRY) are photosensory receptors mediating light regulation of growth and development in certain species. Mouse cryptochrome protein mCRY2 has been found to encode a blue light photoreceptor and is important for mice circadian rhythm. The main goal of the project is to determine the atomic structure of mCRY2, via X-ray crystallography. The mCRY2 gene will be cloned into a vector (pET-DEST42) and expressed in bacterial E.Coli strain BL21 (DE3). Expressed protein will be purified using chromatography and other biochemistry methods. Purified protein will be used to screen to obtain crystals for X-ray diffraction. The mCRY2 gene has been isolated by polymerase chain reactions and is ready to be ligated into the vector. The atomic structure of mCRY2 obtained from this project will facilitate our understanding of its function and also allow prediction of its role in mammalian circadian clocks. Furthermore, the results will guide future mutagenesis and biochemistry studies.

3-15-2011

# Enzymatic Characterization of an Endolysin Mediated by Chaperonin in Bacteriophage phi EL

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# Enzymatic Characterization of an Endolysin Mediated by Chaperonin in Bacteriophage phi EL

Diana A. Tafoya<sup>1</sup>, Nadia Herrera<sup>1</sup>, Sudheer Molugu<sup>1</sup>, Zachariah Hildenbrand<sup>1</sup>, Maxim V. Filchikov<sup>2</sup>, Vadim V. Mesyanzhinov<sup>2</sup>, Konstantin A. Miroshnikov<sup>2</sup>, and Ricardo Bernal<sup>\*1</sup>

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Bacteriophage phi-EL is a virus that attacks the human pathogen *Pseudomonas aeruginosa*. One of the gene products from phi-EL is a putative endolysin. Endolysin is an enzyme produced during gene expression in the lytic cycle of the bacteriophage. Its function is to digest the peptidoglycan layer of the host cell wall, thereby releasing the newly formed virions. In order to confirm the identity of this putative endolysin, the gene product was transformed into competent *E. coli* cells, expressed to high levels and purified to high homogeneity using nickel affinity and size exclusion chromatography. The peptidoglycan-hydrolyzing activity of the protein was characterized using a fluorescence-based assay. Assay results demonstrated that the endolysin activity was similar to the peptidoglycanhydrolyzing activity of *Gallus gallus lysozyme*, which supports the identity of the putative gene product as an endolysin. The kinetics of the reaction have been analyzed and calculated. X-ray crystallography will be utilized to determine the structure of endolysin. Structure determination of this protein will be used to study the lytic cycle of the bacteriophage phi-EL and function of the endolysin. This can lead to manipulation of bacterial lysis that can in turn provide treatments and medication for bacterial infections.

**Environmental Sciences**

**Ecology & Evolution**

**Geology**



3-29-2011

# Using Motion Sensor Cameras to Examine Wildlife Use of Water Bodies in the Northern Chihuahuan Desert

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Alva<sup>^</sup>, Julia S.; Mata-Silva, Vicente; Johnson, Jerry; and Lougheed<sup>\*</sup>, Vanessa, "Using Motion Sensor Cameras to Examine Wildlife Use of Water Bodies in the Northern Chihuahuan Desert" (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 18.  
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# Using Motion Sensor Cameras to Examine Wildlife Use of Water Bodies in the Northern Chihuahuan Desert

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Indio Mountains Research Station (IMRS), in the northern Chihuahuan Desert, contains only one natural, permanent spring but many man-made ephemerally-full tanks, both of which are presumably important for the survival of many species residing in that area. The goal of this study was to examine the utility of utilizing motion sensor cameras to monitor wildlife use of these water bodies, and to determine species-specific preferences for individual water bodies and temporal activity patterns. We installed motion sensor cameras at five different water bodies throughout IMRS. Preliminary results indicate that the dominant mammal visiting these water bodies is peccary (*Pecari tajacu*), which tend to visit the tanks at dawn and dusk. Squaw Spring, the only permanent water body in the area, had the most diversity of mammals, including mule deer (*Odocoileus hemionus*), bobcats (*Lynx rufus*) and grey foxes (*Urocyon cinereoargenteus*). Research on mammal activity in the desert is challenging due to the low density of animals and extreme environmental conditions. This study has illustrated the utility of motion sensor cameras to aid in this research, and has shown that both natural and man-made tanks are important for the survival of many species that reside in this area.

3-29-2011

## Evolution of Melt in Southern New Mexico Using Strontium Isotope Data

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# Evolution of Melt in Southern New Mexico Using Strontium Isotope Data

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Samples have been obtained from along the Rio Grande Rift in southern New Mexico in order to understand the evolution of regional volcanic melts. Lead isotope data has been collected from the Potrillo Mountains, located approximately 35 km to the southwest of the city of Las Cruces, New Mexico, as well as the Elephant Butte region and the Hillsboro Volcanic Field (HVF), both of which are located in Sierra County, New Mexico. The lead isotopes, combined with a few available strontium isotope ratios from this area, suggest that upper mantle melts initially interacted with lower crust, and then were contaminated by variable amounts of upper crust. By running the samples through ion exchange columns, strontium was separated out in order to measure strontium isotope ratios on the UTEP Geology multi-collector mass spectrometer. This allows analysis of the origin of the melts of particularly the HVF, which shows the highest lead isotope ratios and may therefore contain the largest upper crustal contribution. The combined strontium-lead isotope data allows for a critical test of this hypothesis, while a comparison of isotope ratios obtained for rock standards with ratios obtained in other laboratories provides a test of our technique.

3-17-2011

# Preliminary Assessment of Pharmaceuticals and Personal Care Products (PPCPs) in Natural Waters in the El Paso Del Norte Area and Their Impacts on Aquatic Invertebrates

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## Recommended Citation

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# Preliminary Assessment of Pharmaceuticals and Personal Care Products (PPCPs) in Natural Waters in the El Paso Del Norte Area and Their Impacts on Aquatic Invertebrates

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The Rio Grande is a major source of water for humans and wildlife. The types and concentrations of PPCPs, and their impacts on aquatic life, in the river are virtually unknown. The purpose of this research is to assess their impact on aquatic invertebrates and establish the concentrations of these contaminants in the river and an adjacent wetland. Water and sediment samples were collected from the river and the wetland. Water chemistry parameters were monitored and samples were retained for PPCP analyses. Invertebrates were exposed to PPCPs using modified life cycle tests. LC50 values for caffeine for chironomids ranged from 1.5-1.7 g/L and was 0.4 g/L for rotifer *Platyonus patulus*. Chronic toxicity for *P. patulus* showed a decrease in population growth from the control (0.23) to 300ppm (-0.08) after 5 days. LC50 tests and life cycles tests will be conducted with remaining PPCPs. Because many PPCPs are biologically active, there is the potential for effects on humans and/or non-target organisms when exposed to these compounds in the environment. Thus, monitoring and development of tests that detect more subtle end-points for these compounds are needed.

3-14-2011

# Possible Connections Between a Great Earthquake and an Earthquake Sequence: Samoa Islands (8.1) and Vanuatu Islands

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# Possible Connections Between a Great Earthquake and an Earthquake Sequence: Samoa Islands, (8.1) and Vanuatu Island.

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Dynamic triggering describes the possibility that certain earthquakes cause, or 'trigger' new earthquakes at great distances. Static triggering is common and is known to cause aftershocks very near to the site, generally within two lengths of the ruptured fault. Dynamically triggered events can occur at distances beyond two fault lengths, however the mechanism for how this can occur remains unknown. By examining seismic data collected from possible dynamically triggered events, we may gain a better understanding of the mechanisms at work. On September 29, 2009, an earthquake of magnitude 8.1 took place along a 175 km fault rupture in Samoa, an island along the Tonga Trench in South Pacific Ocean. A week later a string of earthquakes occurred over 2000 km away, well beyond the bounds for static triggering, on Vanuatu Island in the South Pacific. Utilizing the USGS and Global CMT website yielded seismic data including magnitude, depth, and location that were plotted and mapped to investigate these earthquake events. Future research aims to analyze this data more thoroughly, as well as compare it to accepted instances of dynamic triggering in the hopes of determining if the Samoa earthquake is an example of dynamic triggering.

3-16-2011

## Detecting Unmarked Graves using GPR at the Mescalero Apache Reservation

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# Detecting Unmarked Graves using GPR at the Mescalero Apache Reservation

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In Mescalero, New Mexico, on an Apache Indian Reservation, we were asked to survey the Mescalero Cemetery in order to locate unmarked graves. Back in the late 1800's, proper documentation of graves was never made. As a result, what is thought to be a new potential burial site is discovered to be an old undocumented grave. Reservation officials have asked us to survey the cemetery and document exact locations of unmarked graves. To achieve this goal, we will use ground penetrating radar (GPR) and a differential global positioning system (DGPS). The collected data will be processed by using EKKO-Mapper and EKKO-View Deluxe. These data processing programs will allow us to view our collected data, edit noise out of the data, and enable us to view our surveyed area in Google Earth by applying DGPS points obtained during the survey. From the processed data, we will identify possible grave sites and inform the reservation officials of the findings. There are three cemeteries in the region and our initial study will only cover part of one of the cemeteries. This project could continue for many years and generate a number of research projects.

3-15-2011

## Evolutionary Genetics of African Toads (Anura: Bufonidae: Amietophrynus)

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# Evolutionary Genetics of African Toads (Anura: Bufonidae: Amietophrynus)

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African "true" toads (frog genus *Amietophrynus*) include 39 morphologically conserved species that live in a panoply of habitats from the fringes of the Sahara to the mountains of South Africa. We examined the evolutionary relationships of these African bufonids by sequencing a 550 bp fragment of the 16S mitochondrial gene, and based on these results, collected a further 4 kb of combined mitochondrial (12S–16S) and nuclear (CXCR4, POMC, and RAG1) sequence data from sixty-two divergent samples of the genus *Amietophrynus*, and several bufonid outgroups. DNA sequences were analyzed with maximum parsimony, maximum-likelihood and Bayesian inference with the programs PAUP, RAxML and MrBayes v.3.1, respectively, after appropriate models of nucleotide substitution were identified in the program jModelTest. Our phylogeny agrees in most respects with the results of the most comprehensive, previously published hypothesis investigating the relationships of African bufonids (e.g., the monophyly of African *Amietophrynus* is well supported). However, our improved taxonomic sampling and resulting phylogeny supports several novel relationships, elucidates chromosome evolution in the group, demonstrates the importance of the Congo Basin as a center of endemism, and notes widespread cryptic speciation, suggesting that current diversity of *Amietophrynus* is vastly underestimated.

3-10-2011

## Changes in Dissolved Organic Carbon (DOC) in Arctic Tundra Ponds Over the Past 40 Years

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# Changes in Dissolved Organic Carbon (DOC) in Arctic Tundra Ponds Over the Past 40 Years

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With a warming Arctic, degradation of permafrost is expected to release organic and inorganic materials into aquatic ecosystems; however, there are few long-term datasets with which to test this prediction. The Arctic tundra ponds at the International Biological Program (IBP) site in Barrow, Alaska, studied for the first time in the 1970s, represent one of the very few locations in the Arctic where long-term data are available on freshwater ecosystem structure and function. Dissolved Organic Carbon (DOC) is used to describe the thousands of dissolved compounds found in water that derive from organic materials. The objective of this study was to determine whether DOC concentrations had changed over time in the IBP ponds. Over the summer of 2010, we collected DOC samples from 5 IBP ponds, as well as several ponds in more isolated locations (BEO) and urban locations. We observed higher DOC concentrations in the IBP ponds in 2010, compared to the 1970's, when temperatures were lower. Urban sites tended to have higher DOC than non-impacted sites. This study will add to our understanding of DOC release into Arctic aquatic environments, and will increase our understanding of the impacts of Arctic warming and development on global carbon cycles.

3-16-2011

## Effects of Cerium Oxide Nanoparticles on Glycine Max Grown in Hydroponics

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# Effects of Cerium Oxide Nanoparticles on *Glycine Max* Grown in Hydroponics

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Cerium oxide nanoparticles (NPs) or nanoceria have a high level of UV absorption and antioxidant behavior, making them great candidates for sun screens, beauty products, and in treating cancer and glaucoma. The increased use of these NPs underscores the importance of understanding their environmental fate and toxicity. So far, information about nanoceria toxicity to plants is scarce. The objectives of this study are to determine the effect of CeO<sub>2</sub> NPs on soybean (*Glycine max*) plant growth and monitor their uptake, deposition, and biotransformation. Soybean plants were treated for 14 days in a modified Hoagland solution containing varying concentrations of CeO<sub>2</sub> NPs (0, 500, 1000, 2000, and 4000 mg/L). Leaves, stems, and roots of the treated soybean plants were analyzed separately using ICP-OES and XAS. The ICP-OES results showed cerium concentrations in roots varying from 37068 - 74774 mg kg<sup>-1</sup>. In stems and leaves there was a maximum cerium concentration of 3028 and 1048 mg kg<sup>-1</sup>, respectively. XAS results suggest that soybeans absorb and store the nanoceria without any biotransformation. Increased growth and growth abnormalities in leaves were found in those plants treated with NPs. A high rate of translocation indicates promising use of soybeans in nanoceria phytoremediation.

3-16-2011

## Seismic Study of Carlsbad, NM

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# Seismic Study of Carlsbad, NM

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Since January 1, 2000, there have been numerous earthquakes recorded in the vicinity of Carlsbad, NM. Importantly, these shallow (10km) earthquakes with magnitudes  $< 4.3$ , do not have a fault or system of faults directly mapped to explain these events. We will be relocating the largest and most recent earthquake, which occurred 25km west of Carlsbad, NM of magnitude 4.1 on March 28, 2010. Data recorded by seismic stations from the USArray, a large National Science Foundation project, and our local Kidd Observatory will be used for this analysis. The use of Standing Order of Data (SOD) allows us access seismograms, and the Seismic Analysis Code (SAC) helps in the analysis of the seismic data. We will correlate the hypocenters of aftershocks to the main event hypocenter, allowing us to identify the fault plane. Once a fault plane has been identified, we will begin work on relocating a second event, thereby identifying the responsible faults. We believe that faulting in this area is related to the Rio Grande Rift extension and can be used as evidence for an active rift.

3-14-2011

# Climate Related Changes in Chemical Characteristics of Arctic Tundra Ponds Over the Past 40 Years.

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# Climate Related Changes in Chemical Characteristics of Arctic Tundra Ponds over the Past 40 Years.

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The Arctic tundra ponds at the International Biological Program (IBP) site in Barrow, AK were first studied in the 1970s and were re-visited in 2010. Recognizing modifications in the ponds' structure and activity is critical to distinguishing possible climate-related impacts on Arctic freshwater ecosystems. The main objective of this project was to re-sample historical pond research sites in order to establish how the physical and chemical characteristics of the ponds have been altered over the past 40 years. Preliminary data from the same IBP ponds sampled in 2009-10 and the 1970's demonstrate an increase of phosphorus and a decrease in nitrate concentrations over time. The increase in phosphorus may be present due to the greater proximity of the IBP sites to urban areas or release from thawing permafrost. Comparisons to other more isolated ponds in the region indicate that the IBP ponds are not nutrient enriched because of their location near the village of Barrow. These data support climate change and permafrost thaw as the principal cause of this nutrient enrichment. Results from this and further studies will lead to a better understanding of the implication of climate change on Arctic tundra pond ecosystems.

3-16-2011

## Effects of Water Quality on Genetic Variation on the Brackish-water Rotifer *Brachionus plicatilis*

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Hinson<sup>^</sup>, Kayla I. and Walsh<sup>\*</sup>, Elizabeth J., "Effects of Water Quality on Genetic Variation on the Brackish-water Rotifer *Brachionus plicatilis*" (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 33.  
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# Effects of Water Quality on Genetic Variation on the Brackish-water Rotifer *Brachionus plicatilis*

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Impacts of water quality on the genetic structure of aquatic organisms have not been well characterized. Unfavorable conditions may result in loss of species diversity and/ or select for tolerant genotypes. We investigated whether aquatic pollutants affect the genetic diversity of the rotifer *Brachionus plicatilis*, common in saline systems. We predict that the genetic diversity of *B. plicatilis* will decrease with lower water quality. An urban population (Ascarate Lake, El Paso Co., TX) was compared with a non-impacted population (Figure Eight Lake, Bottomless Lakes, NM). Basic water chemistry parameters were measured along with heavy metals concentrations. Genetic variation is being determined by sequencing the mitochondrial COI, 16S rRNA genes and the nuclear non-coding ITS region. Water chemistry parameters for both lakes fell within the EPA freshwater chronic criteria except for conductivity, salinity, and TDS. Ascarate Lake exceeded criteria for several metals. Figure Eight Lake exceeded the criteria for one metal and will be used as the non-impacted site. Preliminary analyses of 16S rRNA genes showed no genetic variation among individuals from Ascarate Lake; however it was useful in phylogenetic analysis. Individuals from Figure 8 Lake are being cultured and determination of genetic variation within and between populations is underway.

3-16-2011

## Preliminary Ecological Assessment of Stream Quality in the Sacramento Mountains, New Mexico.

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### Recommended Citation

Martell<sup>^</sup>, Ector M.; Luong<sup>^</sup>, Bianca C.; and Lougheed<sup>\*</sup>, Vanessa, "Preliminary Ecological Assessment of Stream Quality in the Sacramento Mountains, New Mexico." (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 25.  
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# Preliminary Ecological Assessment of Stream Quality in the Sacramento Mountains, New Mexico

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Pollution in freshwater ecosystems has reduced the ability of freshwater habitats to host a variety of organisms. Algal biomass and macroinvertebrate assemblages can reflect stream quality, due to their rapid response to nutrients and limited dispersal ability, respectively. In this study, we used algae and macroinvertebrates as bio-indicators of river quality in the Sacramento Mountains of New Mexico, which is largely forested with some low-level development and cattle grazing. All of our sites ( $n = 3$ ) had a macroinvertebrate Ephemeroptera, Plecoptera, Trichoptera (EPT) index of 50% or greater, which suggest high quality conditions in the river. More specifically, all sites were dominated by the order Ephemeroptera ( $\geq 27\%$ ). Species richness ( $n = 22$ ) was highest in a wetland site upstream and was lowest at the midstream rocky site. Nutrient analysis suggests that, overall, nutrient levels decreased in a downstream direction. There was a sharp increase in nitrates at the site with lowest species richness and the highest phytoplankton biomass; this may be due to an increase in low-level development and cattle grazing, and reduced habitat diversity. Our biological assessment of the streams in the Sacramento Mountains will provide a platform for future research and for developing guidelines for land management, conservation, and restoration efforts.

3-24-2011

## Relation of Recent Seismicity (1988-Present) to the 1958 Huslia, Alaska Earthquake Sequence

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# Relation of Recent Seismicity (1988-Present) to the 1958 Huslia, Alaska Earthquake Sequence

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We have examined how recent seismicity in the Huslia region of central Alaska is related to active faults and the 1958 earthquake sequence (with at least 3 events of magnitude >6). Most of this region is swampy lowland dominated by alluvial material deposited by the Koyukuk River, making surficial identification of active faults difficult. This portion of Alaska is also of interest because it appears to be a region in transition between the strike-slip faulting of the Salcha-Fairbanks-Minto Flats seismic zone and normal faulting of western Alaska (Norton Sound/Seward Peninsula). Researchers have suggested this change in the nature of faulting is due to the rotation of western Alaska away from central Alaska and the formation of a new microplate called the Bering Block. The eastern edge of the Bering Block is postulated to be located just east of Huslia. Our eventual goal is to combine information on recent seismicity, geology and geophysics with a careful analysis of the waveforms of the 1958 sequence in order to better understand the seismic hazards and tectonic processes of the area.

3-16-2011

# Mapping Unmarked Graves in the Mescalero Apache Indian Reservation

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## Recommended Citation

Nauer<sup>^</sup>, Ashley Galusina; Chavez<sup>^</sup>, Stephanie; and Serpa<sup>\*</sup>, Laura, "Mapping Unmarked Graves in the Mescalero Apache Indian Reservation" (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 5.  
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# Mapping Unmarked Graves in the Mescalero Apache Indian Reservation

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Citizens living on the Apache Indian Reservation in Mescalero, New Mexico have experienced difficulty in burying their dead because when they dig a new grave, they often find a body from an earlier burial. The reservation does not have rigorous rules on locating and marking graves and, thus, there are numerous unmarked burial sites within and outside of the existing cemeteries. Officials from the reservation approached the Geological Sciences Department for assistance to map grave locations in the area's three graveyards. In this project, we will use shallow ground-penetrating radar (GPR) to find the graves and digital global positioning system (DGPS) to pin point actual locations of the graves. To process the raw data collected in the field, we will use Ekko View Deluxe software to apply gains and other editing techniques to present our results on a map in various formats such as a \*.kml file for Google Earth. Our goal is to complete collection and processing of our findings in one out of the three graveyards by May 2011. Completion of the entire project will continue for a few years for future students to partake in research experience.

3-16-2011

## Studies of Seismicity near the Active Volcano Mt. Spurr

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### Recommended Citation

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# Studies of Seismicity near the Active Volcano Mt. Spurr

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Seismicity patterns and fault orientations can indicate local stress fields related to volcanic eruptions. There have been many moderate magnitude, shallow earthquakes occurring in the Strandline Lake region about 100km from Anchorage, Alaska near the active volcano, Mt. Spurr. Previous researchers have found that the local stress under Mt. Spurr, before and after its 1992 eruption (1992-1997), differed from the regional stresses, which are related to subduction of the Pacific Plate and Yakutat micro plate. We are analyzing location and patterns of earthquakes occurring since 1998 to determine if more recent seismicity is similar to that occurring before or after the 1992 eruption. We obtained about 933 events using the Alaska Earthquake Information Center website (AEIC). Two major groups of earthquakes were found: one directly linked to volcanic activity, and the other possibly associated with the active Capps Glacier Fault. Seismic arrival times from the AEIC will be used to relocate the positions of recent earthquakes more precisely. The relocations will then be compared to geologic and other geophysical information. First motions of seismic waves will be used to help determine orientation of small faults that produced earthquakes. Seismicity patterns and fault orientations will tell us if the stress field since 1998 is the same as pre-eruption or post-eruption.

3-10-2011

## Reduced Activity of Multiple Endocrine Disrupting Compounds: $17\beta$ -Estradiol and Bisphenol A with a Chemi-luminescent Assay

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### Recommended Citation

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# Reduced Activity of Multiple Endocrine Disrupting Compounds: 17 $\beta$ -Estradiol and Bisphenol A with a Chemi-luminescent Assay

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The concern about the impacts of endocrine disrupting compounds (EDCs) in the environment has increased recently with their high occurrence in surface waters and sex changes in various aquatic organisms. EDCs include ubiquitously used pharmaceuticals and personal care products, such as soap, detergents, contraceptives, and other medicines, which are released constantly into the environment, in waste water treatment plant effluent. Though toxicological effects of these individual, EDCs have been studied, knowledge on how these chemicals interact together in the environment is very limited. The objective of this project is to study the multi-residue effect of EDCs using a chemi-luminescent yeast assay with *Saccharomyces cerevisiae*. The dose response curve for 17 $\beta$ -Estradiol (E2, a natural hormone) ranging from 10pM to 500nM alone with varying concentrations of the Bisphenol A (BPA, a monomer used in many chemical products) EC50 was used at concentrations of 3.43E-7M, 3.43E-6M, and 3.43E-5M. Results indicate reduced estrogenic activity with multiple combinations of E2 and BPA. The EC50 for all the experimental treatments was found to be more estrogenic than the individual BPA EC50. These results lessen the gap on knowledge about EDC interactions in surface waters, and provide new information for future toxicological data on aquatic environmental health.

3-14-2011

## Are Elevated Nutrient Levels in Arctic Tundra Ponds Due to Permafrost Thawing?

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# Are Elevated Nutrient Levels in Arctic Tundra Ponds Due to Permafrost Thawing?

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Continued warming of the arctic tundra in northern Alaska can have important ecological implications for freshwater ecosystems. An increased active layer depth can lead to nutrient release from permafrost. Comparisons of water quality parameters from the 1970s and 2008-09 from tundra ponds in Barrow, Alaska indicated an increase in water column Total Phosphorus (TP), Soluble Reactive Phosphorus (SRP), Total Dissolved Phosphorus (TDP) and algal biomass (phytoplankton) over time. We designed an incubation experiment to look at nutrient release rates from permafrost and active layer cores under different warming scenarios. Although water column data have shown an increase in phosphorus species over the past 40 years, permafrost core incubations showed high concentrations of nitrogen species being released from sediment. In particular, ammonia concentrations were significantly higher in permafrost incubations compared to the active layer incubations. Understanding the release of nutrients from the permafrost can help delineate nutrient concentrations that will be added to arctic tundra pond ecosystems with warming.

3-16-2011

# Using Gravitational and Magnetic Data to Understand Interactions Between Active Seismic Zones Within the Interior of Alaska

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## Recommended Citation

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# Using Gravitational and Magnetic Data to Understand Interactions Between Active Seismic Zones Within the Interior of Alaska

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Differences in rock density, along with changes in the orientation of the magnetic field, provide vital information about the tectonic environment within the interior of Alaska in a region where outcrop exposure is poor due to recent glacial and fluvial activity. Analysis of the gravity and magnetic field can help identify relationships between recent (1989-2008) and historic (pre-1971) seismicity and suspected strike-slip, reverse, and thrust faults within the region, as differences in density and magnetic properties of materials may be observed across fault zones. Our overall objective is to better understand the complicated interactions between the strike-slip Denali fault system and surrounding faults, especially how the 2002 M=7.9 Denali fault earthquake may have brought surrounding faults closer to failure.

3-14-2011

## Precipitation Accumulation Differentiations in El Paso, Texas and Surrounding Areas

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### Recommended Citation

Torres<sup>^</sup>, Nessly and Pannell<sup>\*</sup>, Keith, "Precipitation Accumulation Differentiations in El Paso, Texas and Surrounding Areas" (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 38.  
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# Precipitation Accumulation Differentiations in El Paso, Texas and Surrounding Areas

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The city of El Paso is built around the Franklin Mountains thus splitting the metropolitan area into four ecologically distinct sections: northwest, west, northeast, and east. However, each segment differs in precipitation accumulation. The intent of this research is to compare current to previous rainfall accumulation data and uncover the factors that have influenced the levels of precipitation around the city over time. Additionally, rainfall accumulation and influencing factors are compared to those of surrounding cities (Las Cruces, NM, Ruidoso NM, Albuquerque, NM, Midland, TX, and Tucson, AZ). Precipitation information was collected using data from the National Weather Service and from Fire Stations. Results show that the geographical locations tested did not have more consistent rainfall than other geographical locations over time. The El Paso metropolitan area will benefit from this research by further understanding precipitation patterns, which will allow future storm water diversion engineering and storm water treatment from industrial contamination.

4-1-2011

# The Role of Underflows and Climate on Sediment Distribution in Glacial-fed Lake Linné, Svalbard, Norway

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## Recommended Citation

Zamora-Reyes<sup>^</sup>, Diana; Lougheed, Vanessa L.; Werner, Alan; and Roof<sup>\*</sup>, Steven, "The Role of Underflows and Climate on Sediment Distribution in Glacial-fed Lake Linné, Svalbard, Norway" (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 10.  
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# The Role of Underflows and Climate on Sediment Distribution in Glacial-fed Lake Linné, Svalbard, Norway

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Linnévatnet (78° 2'N, 13° 49'E), is a glacial-fed lake located in Svalbard, an archipelago north of Norway. Sediments found in the lake are supplied by the Linné Glacier, 8km south of the lake, and are transported by the melt stream into the lake, creating laminations with a strong signal of seasonal deposition. Due to its immaculate environment and recent rapid increase in temperature, this site is an ideal place to study past-climate proxies and determine how the changing environment is affecting the area. The objective of this study is to determine the frequency of water underflows influencing sediment distribution and how they are related to weather patterns. Loggers recorded water temperature at 6 depths in 2 separate stations; weather was logged at an adjacent weather station. Underflow events, identified based on large changes in water temperature at the deepest loggers, were most common near the stream inflow. These events were most often correlated with changes in wind direction, wind speed and precipitation.

In the future, underflows will be compared to time-lapse pictures of the lake, data of an interval-ometer -which records the amount of sedimentation- and tilt data to see how lake processes affect sedimentation distribution throughout the lake.

**Physics**

**Mathematical Sciences**

**Bioinformatics**



3-16-2011

# Increasing Efficiency in Boundary Security with Wireless Sensor Networks and Geospatial Information Systems using Homology Theory

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Berumen<sup>^</sup>, Luis; Chaidez<sup>^</sup>, Eric; Dogan<sup>\*</sup>, Hamide; and Rosiles<sup>\*\*</sup>, Jose Gerardo, "Increasing Efficiency in Boundary Security with Wireless Sensor Networks and Geospatial Information Systems using Homology Theory" (2011). *COURI Symposium Abstracts, Spring 2011*. Paper 40.

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# Increasing Efficiency in Boundary Security with Wireless Sensor Networks and Geospatial Information Systems using Homology Theory

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As part of an institutional investigation, we attempt to address the challenges the US customs and Border protection agency faces in the El Paso region. Our research focuses on defining a system for the surveillance application, and the use of mathematical models employed to achieve a greater efficiency of such architecture. With the use of the defined system, we apply homology theory through the algebraic process of topology, to accomplish an independent coordinate-free based system, which covers the surveillance area, with lesser quantity of sensor nodes. Our architecture makes the use of an operating system for wireless sensor networks; TinyOS, a high-level programming language for interface; Java, data records management; MySQL, geospatial information systems; ArcGIS, and rich intranet application for interpretation; Silverlight. The combination of the determined technologies was chosen to form a novel approach to address security, compatibility, and increased efficiency.

3-16-2011

# Equations of State of a Strongly Interacting Dense Fermion System

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# Equations of State of a Strongly Interacting Dense Fermion System

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Our ultimate goal is to study the possibility of color superconductivity in neutron stars. Under the high densities that prevail within some neutron stars the quarks are liberated from the nucleons, and due to their strong interaction they can form di-quark pairs that act as Cooper pairs in a BCS phase. If the interaction between the quarks is stronger than it is for the Cooper pairs, which could be realized if the stars density is decreased, then the pairs can become Bose-Einstein condensates, with totally different characteristics. We investigate the equations of state in the two mentioned regimes of dense matter interacting by the strong nuclear force, find the energies and pressures in the two respective regimes and represent the results as graphs of the crossover parameter and the density. To do so, we made a program to numerically solve a system of integral equations in terms of the energy gap, and chemical potential, from which we can determine the energy and pressure of the core of the star. The outcome of our investigation would be a significant result for the field of astrophysics where the state of matter in the superdense cores of neutron stars still remains unknown.

3-23-2011

# Quantum Mechanical Model of the Hydrogen Atom

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# Quantum Mechanical Model for the Hydrogen Atom

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The quantum mechanical wave function of an object under a certain potential is determined by the Schrödinger equation. It is known that the latter equation can be solved analytically only for a finite number of distinct potentials, being a Coulomb potential one of them. For an electron in a hydrogen atom, we analytically find the angular parts of its wave function by the usual method. Under the appropriate change of variable, the radial part of the equation is turned into a Legendre differential equation whose solutions are Legendre polynomials. Using finite difference method and shooting method taking into account physically meaningful boundary conditions we obtain a numerical approximation for the Legendre differential equation. The numerical approximation of the radial part along with the analytical solutions for the angular parts are used to simulate the wave functions of an electron in a hydrogen atom for different quantum numbers.

3-16-2011

## Modeling of Solvent Electrostatic Effects

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# Modeling of Solvent Electrostatic Effects

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The photo-induced charge-transfer process is fundamental to light harvesting in organic donor-acceptor systems. The process is often enhanced when the system is in a polar solvent. The aim of this project is to create a simple, discrete model containing dipoles that can explain the solvent effects, where only dipole-dipole solvent interaction is considered. The goal is to reduce computational complexities and cost. We create a grid of solvents (water) which mimic the solvent's density; and put one solute (a light-harvesting triad of  $\beta$ -carotene, porphyrin, and C60) at the grid's center, keeping the grid points 1.5 times the Van der Waal radii away from the solute atoms. The solute's partial charges and the solvents dipoles create an electrostatic field which determines the solvent configurations. Using Monte-Carlo method and classical electrostatics at a given temperature we obtain the lowest energy and the average configuration of the grid. Our calculations are performed at  $T=300\text{K}$  and  $T=10\text{K}$  for the ground and charge-transfer excited states of the solute. The field due to the solvents can be used in quantum mechanical calculations to determine the solvent effects. Future work will include the induced dipole moments of the solvents into the calculation and also use a variable grid.

3-29-2011

# Two-Photon-Excited Tryptophan Fluorescence Microscopy for Leukocytes and Cancer Cells Imaging

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# Two-Photon-Excited Tryptophan Fluorescence Microscopy for Leukocytes and Cancer Cells Imaging

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Cancer screening and early diagnosis is an important yet controversial issue due to the safety and practicality of methods used. Our objective is to study the efficiency of an *in vivo* two-photon microscope developed in our laboratories to monitor cell inflammation. First, leukocytes were separated by subpopulation. The tryptophan fluorescence intensity level of each type of leukocyte was then quantified with two-photon microscopy, in their naïve and inflamed states, respectively. Finally the tryptophan fluorescence intensity of multiple myeloma cells was quantified and correlated to the resulting images. The cancerous tissue auto-fluorescence from NADH and FAD was also recorded as a control to determine the specificity of the technique. Comparison of the fluorescence of leukocytes and cancer cells has demonstrated the presence of tryptophan in different quantities per cell, thus offering the potential for distinguishing multiple myeloma cells from leukocytes in circulation and record multiple myeloma cell trafficking process. This is a significant advantage over spectroscopy techniques for safe *in vivo* imaging of cancer screening, since it can be applied without the need for labeling. It is potentially applicable for tracking leukocytes and monitoring inflammatory cellular reactions in humans.