2008 Annual REU Poster Session
Hosted by the Office of Undergraduate Research

Wednesday, July 30, 2008
4-6 p.m.
Zachry Engineering Center

Remarks at 5 p.m., Dr. Martyn Gunn
Dean of Undergraduate Programs and
Associate Provost for Academic Services
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*denotes a presenter

Map of 2008 REU Poster Session Layout
Zachry Engineering Center Lobby

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(Posters 19-37)

Section 3
(Posters 38-53)

Section 1
Posters (1-18)

Section 4
(Posters 55-73)

Stairs

Buffet Tables

Entrance
(from Spence)
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Biological, Environmental, and Materials Chemistry Undergraduate Research Experience
Directors: Drs. Holly Gaede and James Batteas
Coordinator: Sandy Manning
Section 1

#1 "The Investigation of Structural and Electronic Properties of Thiolate Bridged Dicopper Complexes"
Boram Lee*; Roxanne M. Jenkins; Marcetta V. Darensbourg

#2 "Green Catalysis of Bayer-Villiger Oxidations with Mixed-Derivative Tin(IV) Phosphonates"
Jordan P. Holsinger*; Abraham Clearfield; Baolong Zhang

#3 "Functionalizing Cellulose with Biotin Using Biotinylated Dichlorotriazine"
Christopher N. Amen*; Sanjiv Lalwani; Eric Simanek

#4 "Characterization of Enzymes of Unknown Function within the Amidohydrolase Superfamily from Mycobacterium tuberculosis"
Vanessa De La Rosa*; Tinh Nguyen; Frank Rauschel

#5 "Nighttime Measurements of NO3 and N2O5 in equilibrium with NOx and O3"
Anna M. Molina*; Katie Perkins, Justine Geidosch, Simon North

#6 "Bilayer Dynamics on Gel Supports"
Ivonne M. Fragoso*; Sean Bard; Paul S. Cremer

#7 "Gold Chemistry - Exploration of Dithiol Ligands"
Brian M. Emerich*; Auburn R. James; Doris Melgarejo; Gina Chiarella; John P. Fackler

#8 "Synthesis of (n-Bu4N)2[Au(i-MNT)]2 Compounds"
Auburn R. James; Brian Emerich; Gina Chiarella; Doris Melgarejo; John P. Fackler

#9 "Total Synthesis of β-Lactone Containing Natural Products: Salinosporamide A and Spongilactone"
Nicholas Krudy*; Henry Nguyen; Sung Wook Cho; Daniel Romo

#10 "Synthesis of Novel BODIPY Derivatives for Biological Applications"
Ivonne Andújar-De Sanctis*; Kevin Burgess

#11 "Calcium Complexes for the Stereoregular Ring Opening Polymerization of Lactide"
Stephanie Wilson*; Otis Karroornirun; Donald J. Daresbourg

#12 "Using Patterned Arrays of Silver Nanoparticles to Probe Plasmon Enhanced Luminescence of CdSe Quantum Dots on GaAs"
Stephanie L. Skiles*; Yang-Hsiang Chan; Stacey Wark; Dong Hee Son; James D. Batteas

#13 "Direct Measurement of the Photodissociation of OBrO"
Deirdre Manion-Fischer*; Kristen Dooley; Wayne Harsbarger; Simon North

#14 "Synthesis and Reactivity of Polyfunctional Phosphonium and Arsonium Lewis Acids"
Daniel M. Gardner*; Francois P. Gabbai

#15 "Synthesis of Small Molecule Models of [FeFe]-Hydrogenase"
Lauren M. Smith*; Michael Singleton; Marcetta V. Darensbourg

#16 "Characterization of Solute Effects on PNIPAM"
David Darmon*; Hui Fu; David Bergbreiter

Summer Undergraduate Research Program in Biochemistry
Directors: Drs. Gary Kunkel and Mary Byrk
Section 1

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Christina Cutting*; Jon Lamb; Dorothy E. Shippen

#18 "Dietary linoleic acid and butyrate suppress apoptosis by enhancing Bcl-2 expression"
Caitlin Cozby*; Yang-Yi Fan; Laurie A. Davidson; Robert S. Chapkin
Cyclotron Institute REU Program
Director: Dr. Sherry Yennello
Coordinators: Ruthy Scribner, Larry May
Section 2

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Shawn Witham*; Ralf Rapp

#20 “Precise Measurements of $\alpha_1$ for the 346.5 keV, M4 Transition in $^{197}$Pt$^{m}$”
James Nolan*; J.C. Hardy; Ninel Nica

#21 “Giant Monopole Resonance”
Anthony Licata*; Dave Youngblood

#22 “Jet Conversions in a Hadronic Gas”
Aaron Hernley*; Rainer Fries

#23 “The Interaction of Nuclei in the Gravitational Fields of Mini Black Holes”
Lauren Greenspan*; Akram Zhanov

#24 “Determination of Impact Parameter for Fermi Energy Heavy Ion Collisions Using the HIPSE Event Generator”
Mike Mehlman*; Sherry Yennello

#25 “Relative Calibration of the Shower Maximum Detector in the Barrel EMC at STAR from 200 GeV Au+Au Data”
Kara Farnsworth*; Saskia Mioduszewski; Martin Codrington

#26 “Reestablishing Precise 32Cl Branching Ratios”
Mark Hernberg*; Dan Melconian

#27 “Modern Energy Functional for Nuclei and Nuclear Matter”
Alberto Hinojosa*; Shalom Shlomo

#28 “Probing 23% of the Universe at the Large Hadron Collider”
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#29 TBA

#30 “Search for a Dark Matter Candidate at the Fermilab Tevatron”
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Erika Navarro*; Carl Gagliardi; Adrianna Banu

#32 “Identifying Drosophila p24 genes that function in reproduction”
Latrice Jones*; Ginger Carney

*poster is located in Section 1

Electrical & Computer Engineering Applications to Homeland Security
Directors: Drs. Karen Butler-Purry, Deepa Kundur, and Takis Zourntos
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Section 2

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Adam Hollock*; Noraica Davila*; Deepa Kundur
Look College of Engineering Undergraduate Summer Research Grants (USRG)
Director: N.K. Anand
Coordinators: Teresa Wright, Raja Siva

Section 2

#34 “Towards a Lightweight, Highly-Capable Mobile Ground-Based Agent for a New Paradigm of Artificial Intelligence Based on Non-Linear Dynamics”
Brett Sutton* (Electrical Engineering), Gabriella Geletzke* (Electrical Engineering), Aditya Mahadevan* (USRG); Takis Zourntos

NSF-REU in Sociology
Directors: Drs. Rogelio Saenz and Mark Tossett
Coordinators: Marilyn Venegas, Glenn Bracey

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Undergraduate Research Scholars
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Section 2

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Stephanie Shively*; Sheela Athreya

#37 “Emerging Markets: Past, Present, Future”
Divya Srinivasan*; Julian Gaspar

Computer Science REU Program
Directors: Drs. Valerie Taylor, Nancy Amato, and Jianer Chen
Coordinator: Theresa Roberts

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Lena Olson*; Adam Fidel*; Antal Buss; Timmie Smith; Gabriel Tanase; Nathan Thomas; Nancy M. Amato; Mauro Bianco; Lawrence Rauchwerger

#39 “Conformal Mesh Parametrization”
David Mann*; Scott Schaefer

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Gen Kazama*; Yoonsuck Choe; John Keyser

#41 “Sensor Integration for TamuBot”
Benjamin Fine*; Dezhen Song

#42 “SOUUSA: The Sketch-Based Online User Study Application”
Emily Jacobson*; Brandon Kaster*; Tracy Hammond

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Drew Fisher*; Dimitri Loguinov
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Zhao Lin*; Jing Xiang Chai
#47 "Registration and Labeling of Mouse Brain Atlases using Free-form" Kasra Manavi*; John Keyser; Yoonsuck Choe
#48 "Wireless Communication System for TAMU Bot Robotic Research Platform"
Tyler J. Southard*; Dezhen Song
#49 "Performance Analysis of a Computational Biology Code" Timothy Campbell*; Valerie Taylor; Xingfu Wu
#50 "Performance Analysis and Comparison of MPI, OpenMP and Hybrid NPB-MZ" Hector J. Machin*; Valerie Taylor; Xingfu Wu
#51 "Traversing Surfaces using Two Module Bridges of Hexagonal Self-Reconfigurable Metamorphic Robots" Isaac Krull*; Jennifer Walter
#52 "Using a Pocket-Filling Strategy for Distributed Reconfiguration of a System of Hexagonal Metamorphic Robots in an Obstacle-Cluttered Environment" Stephen Matysik*; Jennifer Walter
#53 "Nearest Neighbor Search In Motion-Planning"
B. Lakshmi Reddy*; Nancy Amato
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Orianna DeMasi*; Kathy Li*; Yuliya Gorb; Jay Walton

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Coordinator: Donna Hoffman

Section 3

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Orianna DeMasi*; Kathy Li*; Yuliya Gorb; Jay Walton

**Development of Microturbo Machinery**

Directors: Drs. Wayne Hung and Luis San Andres

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*Kathleen Hagen; Luis San Andrés
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*Brian Rice; Luis San Andrés; Keun Ryu; Thomas Chirathadam
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J. Soule*; L. Calhoun; F. Ozkerskin; S. Sundarram; W. Hung
#59 "Precision Tooling for Manufacturing of an Underspring for a Generation II Gas Foil Bearing"
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#60 "Optimal Micromist for Effective Micromachining"
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L. Calhoun*; J. Linnell; S. Sriharsha; F.M. Ozskin; W. Hung

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Director: Dr. Kevin Heinz
Coordinators: Rebecca Hapes, Dr. Darrell Bay
Section 4

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G. M. Villescas III*; L. S. Bales; K. J. Maragathavally; C. J. Coates

#63 “Usage of Chimeric piggyBac transposases in site-directed integration”
L. S. Bales*; G. M. Villescas; K. J. Maragathavally; C. J. Coates

#64 “Amblyomma Americanum Tick Chitinases: A Molecular and Biological Characterization”
Jeanette Curran*; Albert Mulenga

#65 “Diet Affects Oviposition Timing in Blow flies (Diptera: Calliphoridae) on Decomposing Remains”
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#66 “Detection of Host-Associated Differentiation of Acrobasis vaccinii in a Native Fruit System”
Kyle Harrison*; Raul Medina

#67 “Cloning and sequencing the calcitonin receptor-like receptor 3 (AaegGPRCal3) from female mosquitoes of Aedes aegypti (L.) (Diptera: Culicidae)”
Cymon N. Kersch*; HyeogSun Kwon; Patricia V. Pietrantontio

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*Ashley McConnell, Karl Roeder, Dr. Spencer Behmer, Dr. Anthony Zera

#69 “The effect of resource age and sterilization on the attraction of Cochliomyia macellaria (Fabricius) and Chrysomya ruffificacies (Macquart)”
Francisco Ortiz*; Dr. Jeffery Tomberlin

Department of Plant Pathology and Microbiology Summer REU
Directors: Drs. Carlos Gonzales and Paul de Figueiredo
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Isabella Ruiz*; Brian Shaw

#71 “Microdiesel’s potential for sustainable production of biofuels”
Paul de Figueiredo; Lei Li; Oscar Sosa*

#72 “Functional Analysis of the Gene Cluster Encoding Gliotoxin in Trichoderma virens”
David A. Laughlin*; Walter A. Vargas; Prasun Mukherjee; Charles M. Kenerley

#73 “Establishing physiological and biochemical function of selected lipoxygenase genes”
Eli Borrego*; Chestley Miller; Shawn Christensen; Michael Kolomiets
Abstracts

#1 "The Investigation of Structural and Electronic Properties of Thiolate Bridged Dicopper Complexes"
Boram Lee*; Roxanne M. Jenkins; Marcetta J. Darensbourg

Copper is an important cofactor in metalloproteins and is involved in processes such as electron transfer, oxygenation, hydroxylation and oxidation. Type III copper centers incorporate coupled dicopper sites comprised of two Cu(II) centers as found in oxyhemocyanin and oxytyrosinase. A mixed valent system comprised of a Cu(II) and Cu(I) center is found in cytochrome c oxidase and nitrous oxide reductase. We are particularly interested in studying the coordination chemistry of dinuclear copper complexes bridged by thiolate ligands in attempts to understand structure/function relationships. Small molecule models of enzyme active sites which mimic the structure frequently show similar reactivity which gives insight into the mechanism catalyzed by the enzyme.

Cu(II) dimeric complexes were prepared using the tridentate N₃S ligand based on me-mdach (mercaptoethylmethyl-diazacycloheptane), yielding compounds with a molecular formula of Cu₂N₄S₂C₁₆H₃₂Cl₂. Counter ion effects were studied to explore structural and electronic changes in the Cu(II) dimer. Using a coordinating counter ion such as chloride, ESI-MS and X-ray crystallography suggests a dinuclear Cu(II) complex is formed. Counter ion exchange with a bulky or less interacting counter ion, BF₄⁻, indicated the structural integrity of the dimer was maintained. Furthermore, ESI-MS suggests that exchanging the chloro ligand with imidazole resulted in the cleavage of the dimer into a mononuclear species. The electronic and structural properties of the Cu species formed will be presented.

#2 "Green Catalysis of Bayer-Villiger Oxidations with Mixed-Derivative Tin(IV) Phosphonates"
Jordan P. Holsinger*; Abraham Clearfield; Baolong Zhang

Phenylbis(phosphonic acids) have previously been shown to be effective catalysts in solvent-free Baeyer-Villiger (BV) oxidations of aromatic aldehydes using hydrogen peroxide. The focus of this research was to synthesize mixed-derivative tin(IV) phosphonates and use them as catalysts in green BV oxidations. Hydrothermal synthesis of tin chloride and various phosphonic acids yielded highly porous, mixed-derivative tin(IV) phosphonates with phenylbis(phosphonic acid) pillar groups and chemically active spacer groups. The phosphonates were characterized by thermal gravimetric analysis, IR, powder x-ray diffraction, surface area, and ⁳¹P NMR. They were then used to catalyze the BV oxidation of anisaldehyde to determine whether the chemical activity added by the spacer groups increased their efficiency as catalysts. They were also used to catalyze other solvent-free BV oxidations that typically require the addition of an acid as well as a solvent.

#3 "Functionalizing Cellulose with Biotin Using Biotinylated Dichlorotriazine"
Christopher N. Amen*; Sanjiv Lalwani; Eric Simanek

This project's objective was to synthesize a biotin derivative that would react with cellulose. Cotton swabs functionalized with biotin should open a possible way of designing antibody test kits via avidin-biotin complexation chemistry. The synthetic route to attain biotinylated cellulose began by functionalizing biotin with 3,6,9-trioxaundecanediylamine. This was done in a one-pot reaction using pentafluorophenol and dicyclohexylcarbodiimide (DCC) to form the activated ester and then adding the 3,6,9-trioxaundecanediylamine to form the biotinyl-3,6,9-trioxaundecanediylamine. After purification, the biotinylated amine was reacted with cyanoacrylic chloride to form a biotinylated dichlorotriazine. With the fact that dichlorotriazine dyes are commonly used in staining cotton in mind, the biotinylated dichlorotriazine was reacted with a cotton swab. This reaction was measured indirectly by monitoring the rate of disappearance of the dichlorotriazine through UV spectroscopy. The biotinylated cellulose was also measure using an ELISA type assay with BCPI (5-bromo-4-chloro-3-indolyl phosphate) and NBT (nitroblue tetrazolium) solution.

#4 "Characterization of Enzymes of Unknown Function within the Amidohydrolase Superfamily from Mycobacterium tuberculosis"
Vanessa De La Rosa*; Tinh Nguyen; Frank Rauschel

The amidohydrolase superfamily is a set of enzymes that predominantly catalyze the hydrolysis of substrates with amide or ester functional groups at carbon and phosphorous centers. The structural marker of this family of enzymes is a mononuclear or binuclear metal center embedded in a TIM-barrel structural fold. The purpose of this project is to characterize and ultimately determine protein structure and enzymatic activity for proteins of unknown function. A series of nine proteins of the amidohydrolase superfamily from the organism Mycobacterium tuberculosis were analyzed for overexpression, solubility and ease of purification. The expression of proteins was
tested over a range of IPTG concentrations at both room temperature and at 17°C. The proteins were purified using size exclusion and ion exchange chromatography. Results showed the proteins overexpressed and were soluble, each under different conditions. The ease of purification and activity requires further investigation. Determining the function and structure of these enzymes will lead to a better understanding of the relationship between sequence, structure and function within the amidohydrolase superfamily.

#5 “Nighttime Measurements of NO and NO2 in equilibrium with NOx and O3”
Anna M. Molina*, Katie Perkins, Justine Geidusch, Simon North
Nitrogen oxides (NOx) released by human activities play an important role in atmospheric reactions and air quality. They constitute the major precursor of photochemical smog formation in the troposphere, in conjunction with volatile organic compounds and ozone (O3). When the sun sets, nitrogen oxide compounds undergo reactions to produce two new nitrogen-containing gases that exist mainly at night, nitrate radical (NO3) and dinitrogen pentoxide (N2O5), both species being in equilibrium. The heterogeneous reaction of N2O5 and H2O to form HNO3 serves as a sink or a reservoir for NOx, which directly impacts the O3 formation in the following day.

In order to understand the role played by some of these species, a method for the simultaneous detection of the NOx and N2O5 free radicals have been developed using Cavity Ring-down Spectroscopy (CRDS). CRDS is a highly sensitive absorption measurement technique based on the integrated intensity passing through a high-finesse cavity. Highly reflective mirrors are used to reflect a single light photon for finite periods of time in order to measure the time decay of light intensity from the optical cavity. The CRDS technique allows measurements of gases down to the ppt (ng/m3) level. The instrument was optimized and calibrated and preliminary direct NOx measurements were made.

#6 “Bilayer Dynamics on Gel Supports”
Ivonne M. Fragoso*, Sean Bard; Paul S. Cremer
Stochastic sensing is a method for chemical detection at the single molecule level. It can be applied to the identification and quantification of a range of biological and chemical substances. In this project we created a stable support for lipid bilayers using agarose and silica gels in order to reduce mechanical noise and increase longevity. These gels were applied to clean glass cover slips to which vesicles with Texas Red-dyed fluorescent lipids are added. Osmotic shock and charged lipids are used to fuse the vesicles into bilayers. The dynamics of these bilayers were subsequently measured by fluorescence recovery after photobleaching (FRAP) and epifluorescence microscopy. With these measurements we were able to determine if the supported bilayers formed were stable, functional, and mobile. After understanding the dynamics of these supported bilayers we will be able to see if this system can be applied to stochastic sensing. It was found that there exists a relationship between the concentration of silica in agarose gels with the formation of a stable and functional bilayer using different concentrations of charged lipids. Gels made without buffer solution were more effective in creating stable bilayers than the gels with buffer solution that caused aggregation of the silica microspheres. Diffusion constants for the bilayers were found to be within the range of those found for control experiments using bilayers on glass without a gel support. We hope to apply this knowledge to the design of new and robust stochastic biosensors.

#7 “Gold Chemistry - Exploration of Dithiol Ligands”
Brian M. Emerich*, Auburn R. James; Doris Melgarro; Gina Chiarella; John P. Jackler
Dinuclear gold compounds containing dithiol ligands have been tested as biosensors for toxic materials. The reaction of aniline and carbon disulfide, in the presence of base, should be able to produce a ligand that has carbon disulfide replacing a hydrogen on the nitrogen group found on aniline. However, this reaction has yet to produce the desired ligand. The reaction has been explored in water, methanol, and ethanol. In alcohol a xanthate was produced, which contained no aniline group, and displayed no phenyl ring on the NMR data. The ligand produced in water displayed a phenyl ring in the region of 7.0 - 7.6 ppm on the NMR spectrum, but through single x-ray crystallography the structure was proven incorrect. Further solvents are being explored, such as acetone and isopropanol, but results have not been calculated at this stage. The incorrect ligands have also been reacted with gold(I) and copper(I) compounds, but have not been characterized at this time.

#8 “Synthesis of (n-Bu4N)2[Au(i-MN)]2 Compounds”
Auburn R. James*, Brian Emerich; Gina Chiarella; Doris Melgarro; John P. Jackler
The compound (n-Bu4N)2[Au(i-MNT)]2 (i-MNT = (S2C2(CN)2)) was resynthesized and oxidized with bromine and methyl iodide. This was done in order to study gold thiol interactions where previous compounds have proved useful in biosensors. The initial synthesis and oxidation with halogens were reported by the Fackler group in the
1980's, but the methyl iodide oxidation, done by addition of methyl iodide to \((\text{n-Bu}_4\text{N})_2\text{[Au}\{\text{i-MNT}\}]_2\) in THF, has not previously been reported. X-ray crystallography was taken of the unoxidized product (experimental: \(A=8.7, B=11.0, C=14.0, \alpha=105.7, \beta=89.6, \gamma=113.4, V=1182\)). Although crystallography data has not yet been collected for the methyl iodide product, a methyl peak present in the \(^1\text{H} \text{NMR of the oxidized material that is non-existent in that of the unoxidized material suggests the oxidation indeed took place. As with similar gold complexes, the oxidation creates a gold-gold bond and changes the gold atoms to the rare +2 oxidation state. Studies of substitution reactions of the methyl iodide oxidation product could potentially lead to different organometallic compounds containing this ligand.}

### #9 “Total Synthesis of \(\beta\)-Lactone Containing Natural Products: Salinosporamide A and Spongiodactone”

Nicholas Krudy; Henry Nguyen; Sung Wook Cho; Daniel Romo

\(\beta\)-lactones are highly strained heterocycles with masked aldol functionality which makes them very useful synthetic intermediates. Furthermore, many recently isolated natural products containing the \(\beta\)-lactone moiety show significant pharmaceutical promise. Salinosporamide A, a potent proteasome inhibitor, is an anti-cancer agent currently in phase I clinical trials. Following a recent total synthesis of \((\pm)\)-salinosporamide, we investigated side chain addition to a key aldehyde intermediate using Grignard reagents. We generated several derivatives for structure activity relationship studies using Grignard addition. Spongiodactone is a \(\beta\)-lactone containing natural product isolated from \(\text{Spongoinella gracilis}\). Spongiodactone has not been synthesized and its bioactivity is currently unknown due to lack of material. Continuing Romo group efforts toward the total synthesis of spongiodactone, we focused on optimizing a shorter route to a key cyclohexene employing a method for \(\alpha\)-alkylation of \(\alpha,\beta\)-unsaturated enones.

### #10 “Synthesis of Novel BODIPY Derivatives for Biological Applications”

Ivonne Andújar-De Sanctis; Kevin Burgess

4,4-Difluoro-4-bora-3a,4a-diaza-s-indacene dyes, known as BODIPY, are commonly used as fluorescent probes. BODIPY dyes exhibit a series of useful advantages such as a high extinction coefficients, sharp fluorescent peaks, good photo stability, high quantum yields and low photoblinking. In addition, they are generally insensitive to the polarity and \(pH\) of their environment, and are therefore reasonably stable in physiological conditions. These dyes have a broad number of applications, such as labeling reagents, fluorescent switches, chemosensors, laser dyes, and biological labels. Even though the core of BODIPY dyes is hydrophobic and have no functional groups, it can be synthetically modified according to their desired application. The synthesis of novel BODIPY dyes for biological applications is presented in this work. These BODIPY derivatives will allow for the study of different phenomena including protein-protein interactions and peptidomimetics. This work will also represent a window of new opportunities for the synthesis of a library of new compounds of biological relevance.

### #11 “Calcium Complexes for the Stereoregular Ring Opening Polymerization of Lactide”

Stephanie Wilson; Osit Karoonrirun; Donald J. Daresbourg

Poly(lactide) is a biodegradable polymer widely used in various medical applications including sutures, drug delivery systems, and tissue engineering. A chiral monomer, lactide can undergo ring opening polymerization to yield stereoregular polymers that display increased degradation rate predictability. Because poly(lactide)'s use is mainly \textit{in vivo}, bio-metal catalysts are desirable for its polymerization. These catalysts would ideally then not need to be removed from the final polymer product, potentially saving both time and money. Calcium complexes with various tridentate Schiff base ligands have been synthesized and examined for both their polymerization activity and their effects on the stereoregularity of the resulting polymer. Specifically, steric changes in the phenolate moiety and chiral tailoring in the imine backbone of the ligand have been investigated.

### #12 “Using Patterned Arrays of Silver Nanoparticles to Probe Plasmon Enhanced Luminescence of CdSe Quantum Dots on GaAs”

Stephanie L. Skiles; Yang-Hsiang Chan; Stacey Work; Dong Hye Son; James D. Batteas

Photoluminescence (PL) enhancement of quantum dots affected by the proximity of silver nanoparticles was studied. To spatially control the attachment of the silver nanoparticles, a self-assembled monolayer of a silane-terminated molecule was patterned on the oxidized GaAs substrate. After the attachment of the nanoparticles, oppositely charged polymer layers were deposited layer-by-layer to create a film which controls the distance between the nanoparticles and quantum dots. CdSe quantum dots (ca. 5.4 nm in diameter) with a 16-mercaptophexadecanoic acid surfactant were absorbed on the outermost polymer layer via electrostatic interactions. The enhancement of PL of the quantum dots over the silver nanoparticles and the PL of quantum
dots in areas without silver nanoparticles can be imaged by confocal laser microscopy. Using this approach, the PL enhancement as a function of the number of polymer layers was investigated.

# 13  "Direct Measurement of the Photodissociation of OBrO"
Deirdre Manion-Tischer; Kristen Dooley; Wayne Harsarger; Simon North

The chemistry of atmospheric chlorine compounds and their impact on the destruction of ozone are well understood. However, less is known about other halogens and their oxides as intermediate and source compounds. OBrO has recently received attention because it has been observed in the arctic stratosphere at night. We would like to study the photodissociation of OBrO in order to better understand its chemistry in the atmosphere. We have set up an ion-imaging experiment to measure the Br atom products from the Br + O_2 dissociation channel of OBrO. In order to study OBrO with our instrument, we need to first produce it in a molecular beam. This can be done by trapping and then warming the condensed effluent of a microwave discharge of a mixture of small concentrations of O_2 and Br_2 in Ar. Characterization of the discharge products is in progress.

# 14  "Synthesis and Reactivity of Polyfunctional Phosphonium and Arsonium Lewis Acids"
Daniel M. Gardner*; Francois T. Gabba

The medical significance of the fluoride ion (F⁻) has led to many investigations of novel molecular sensors for such ions in solution. Our group has previously developed several F⁻-selective sensors based on cationic boranes. Success with polyfunctional ammonium and phosphonium boranes has led us to consider derivatives with other group 15 elements. We wondered if the Lewis Acidic behavior by the phosphonium center in o-phosphonium borane could be extended to diphosphonium and diarsonium species. Here we report the synthesis of diphosphonium and diarsonium compounds as well as the interactions of these molecules with F⁻, H, ¹H, ¹⁹F and ³¹P NMR spectra of the compounds show significant changes upon addition of a F⁻ source suggesting that F⁻ interactions cause conformational changes. Computational studies predict that F⁻ ions interact strongly with the cationic centers of these compounds. The structure of the fluoride adduct of the dianion compound has been optimized and predicts bidentate complexation of the F⁻ counter anion. In contrast, the optimized structure of the fluoride adduct of the diphosphonium compound predicts that the F⁻ counter anion only interacts with one of the phosphonium atoms. We would also like to report the synthesis and properties of an arsonium borane. These findings suggest that group 15 polyfunctional Lewis Acids may act as useful molecular sensors.

# 15  "Synthesis of Small Molecule Models of [FeFe]-Hydrogenase"
Lauren M. Smith*; Michael Singleton; Marcetta Y. Darenbourg

[FeFe]-hydrogenase is an enzyme that has been found to produce hydrogen at rates rivaling the Platinum electrodes currently used in fuel cells. There is potential for biomimetic models utilizing the abundant metals found in nature, i.e. iron, to function as catalysts in a similar capacity. Herein we describe the synthesis of novel small molecule models of the [FeFe]-hydrogenase active site with strongly electron withdrawing dithiolate ligands, (uSC(O)CR2C(O)S), used as bidentate bridging ligands to iron carbonyl units, (uSR's)[Fe(CO)]₂. The ultimate objective of these modifications was to explore how changes to the backbone dithiolate linker affect the redox properties of the iron-sulfur clusters. Our newly synthesized complexes show the most accessible (-1.0 V vs Fc/Fc+) Fe(I)Fe(I)Fe(I)Fe(II)Fe(0) reduction reported to date as indicated by cyclic voltammetry. Electrochemical studies also indicated that these compounds can function as electrocatalysts for hydrogen production. The x-ray structures of these compounds will also be presented, as well as notable symmetry. Attempts of modifications to the thioesters of these structures for attachment to electrodes for possible use as solid phase electrocatalysts will also be described.

# 16  "Characterization of Solute Effects on PNIPAM"
David Darmon*; Hui Ju; David Bergbreiter

Poly(N-alkylacrylamide)s have been widely studied due to their ability to change lower critical solution temperature (LCST) upon mixing with different salts. The effect of these salt solutions on the LCST is known to follow the Hofmeister series. In this work, we investigated the effect of mixed salt solutions on poly(N-isopropylacrylamide). The LCST of PNIPAM was determined by a digital melting point apparatus. The effect of mixed salt solutions was found to be additive for anions. The study of the solute response of PNIPAM was extended to surfaces. The surface of double polished silica wafers and polyethylene films were modified by covalent layer-by-layer assemblies of PNIPAM. The response of those surfaces to various anions and cations.
was characterized by the measurement of contact angles. The contact angles could then be used to determine
the hydrophobicity of the surfaces. The solute effect on hydrophobicity was found to follow the Hofmeister series.

#17  "De Novo Telomere Formation in Arabidopsis thaliana"
Christina Cutting*; Jon Lamb; Dorothy E. Shippen

Telomeres are the specialized protein-DNA structures on the ends of eukaryotic chromosomes. They provide a
solution to the end replication problem and are essential to the stability of the genome. The Shippen lab studies
telomere formation and regulation in the flowering plant Arabidopsis thaliana. Arabidopsis has a short generation
time, so characteristics of telomeres can be studied over multiple generations. The Shippen lab has developed a
system to induce de novo (new) telomere formation by inserting arrays of the plant telomere repeat (TTTAGGG)
into Arabidopsis. The telomere repeat array (TRA) can become a functional telomere causing the loss of the
chromosome arm distal to the insertion site. Primer Extension Telomere Repeat Amplification (PETRA), a PCR
technique, is used to detect de novo telomere formation and to track telomeres in subsequent generations. The
technique was optimized by improving upon variables such as the concentration of DNA and Ex-Taq used and the
number of PCR cycles the reaction ran. Additionally, the use of radiation was minimized by developing a reliable
non-radioactive protocol. The primary goal of this project was to find out if new telomeres would form on
transgenic TRAs that were significantly shorter than wild-type telomeres. It was discovered that transgenic inserts
of telomeric DNA as small as 400 base pairs successfully resulted in the formation of telomeres (compared to 1.5-
5.5 kb in wild-type). Finally, we found that a background lacking lig4, a protein involved in repairing double-strand
breaks in chromosomes, has no significant effect on telomere formation, suggesting that the reduced ability to
repair DNA does not increase the likelihood of telomere formation. These results give us more insight into
Arabidopsis telomeres and will allow for more detailed investigation of new telomere formation in the future.

#18  "Dietary linoleic acid and butyrate suppress apoptosis by enhancing Bcl-2 expression"
Caitlin Cozby*; Yang-Yi Fan; Laurie A. Davidson; Robert S. Chapkin

Bcl-2 is an anti-apoptotic, oncogenic protein that inhibits programmed cell death. This is significant because the
transformation of colonic epithelium to carcinoma is in part associated with a progressive inhibition of apoptosis.
Hence, chemotherapeutic agents which restore the normal apoptotic pathways have the potential for effectively
treating cancers that depend on aberrations of the apoptotic pathway to stay alive. Previously our lab has
examined the effects of putative pro/anti-apoptotic agents in an SV40-immortalized Young Adult Mouse Colon
(YAMC) cell line. Using this model system, we demonstrated that the combination of butyrate (C4:0) and linoleic
acid (C18:2\(\Delta 9,12\)) increased the expression of Bcl-2 at the protein and mRNA level, thereby reducing apoptosis.
This is consistent with previous observations indicating that dietary lipids rich in C18:2\(\Delta 9,12\) (found primarily in
vegetable oils) enhance the development of colon tumors. In this study, our primary objective was to corroborate
these novel findings utilizing an in vivo mouse model system. Colon mucosa was extracted from mice fed diets
with and without C18:2\(\Delta 9,12\) and pectin, a dietary fiber which is fermented in the colon to generate butyrate.
Western blot and qPCR analyses were performed to quantify Bcl-2. Colonic mucosa from mice fed a diet
containing butyrate and C18:2\(\Delta 9,12\) had a 44% increase in Bcl-2 protein (p<0.05) compared to mice fed diets
lacking butyrate or C18:2\(\Delta 9,12\). In contrast, there was no effect of diet on Bcl-2 mRNA levels. These data
indicate that C18:2\(\Delta 9,12\) and butyrate (pectin) synergistically enhance Bcl-2 expression which contributes to the
suppression of mucosal apoptosis.

#19  "Calculating dilepton production from the interactions between pions and a disoriented chiral condensate"
Shawn Witham*; Ralf Rapp

In high energy, heavy-ion collisions, the phase transition from the quark-gluon plasma to a hot hadron gas
happens when chiral symmetry is spontaneously broken. It is theorized that, during this phase transition, there
exists a product called a disoriented chiral condensate or DCC. By studying the effects of DCC formation, more
information about quark-gluon quenching, non-equilibrium dynamics of high energy physics, and the transition
towards chiral symmetry can be used to better understand current research in fundamental physics. In this
project, dilepton production and mass spectra are calculated from the interactions of pions and DCC. These
theoretical calculations are done by using numerical quadrature in FORTRAN and other various computational
methods.
In internal conversion, the excited nucleus interacts with an electron in one of the inner electron shells, causing the electron to be emitted from the atom. The internal conversion coefficient (ICC) is defined as the ratio of the number of de-excitations via electron emission over the number of de-excitations via gamma emission. New developments in internal conversion theory have prompted precise experimental tests of calculated ICs, which have themselves led to further improvements in the theory. One important test case is the nuclide Platinum-197 (Pt-197). In order to determine the ICC for Pt-197, a sample of Pt-196 was irradiated by thermal neutron activation to yield a meta-stable state of Pt-197. X-ray and gamma-ray emissions from this sample were observed; the measured spectra showed that the irradiated sample contained numerous weak impurities. The identification of these impurities and the subtraction of their decay radiation from the spectra were necessary to obtain relatively pure spectra for the meta-stable state of Pt-197. This poster will discuss the process of identifying, analyzing, and subtracting these numerous impurities.

The Isoscalar Giant Monopole Resonance (ISGMR) is one of the ways to determine the compressibility of nuclear matter (Knm). This Knm is used to find the equation of state for nuclear matter. Also, it is used in astrophysics concerning supernova and neutron stars. To determine this Knm more accurately, we need to find the ISGMR for many nuclei. Work is now being done to move from stable nuclei to unstable nuclei in order to more accurately determine the Knm. Lithium (6Li) scattering has been proposed as an alternative to alpha scattering in measuring the giant resonance. Also, with 6Li scattering, the inverse reactions of unstable nuclei can be studied with 6Li as a target. Work is being done to improve the target chamber detectors to measure position and energy.

The goal of this research was to find solutions to the Schrodinger equation that describe particle scattering around black holes on the order of ten solar masses. Black holes of this kind could have formed right after the big bang and weigh over eighteen orders of magnitude more than our sun. Since mini black holes can be comparable in size to nucleons, the project also considers the limit at which the black hole must obey Quantum Mechanical law. In order to study a gravitational object in space, a convenient coordinate system must be assigned to the system. To get rid of unwanted singularities we chose the Eddington-Finkelstein metric and used it to evaluate the Klein-Gordon equation. From this we derived the potential for the black hole and used it to find Eigenfunctions that described its energy. We found that terms of our equation described a relationship between gravitational (via the Newtonian potential) and absorption (via complex potential), and used these to investigate black holes with varying Schwarzchild radii.

Attempts were made to deduce impact parameter from observables generated by the HIPSE (Heavy-Ion Phase-Space Exploration) event generator, which was filtered to approximate data output by the NIMROD particle detector. Distributions of hypothetical observables for four systems (70Zn on 72Zn, 64Zn on 64Zn, 64Ni on 64Ni, and 64Zn on 64Ni, all at 35MeV) that were expected to correlate with impact parameter were mapped to distributions of event impact parameter output by the HIPSE event generator by matching percentages of each distribution. Fifteen different quantities were considered for correlation, several of which ultimately yielded useful separation of
impact parameter. Two quantities, charged particle multiplicity and total event transverse momentum (both subject to a Z-V cut), were then chosen to train a Neural Net to predict event impact parameter. The Neural Net demonstrated promising, though incomplete, correlation. Results are presented for correlations stemming from both the mapping and Neural Net analyses.

#25 "Relative Calibration of the Shower Maximum Detector in the Barrel EMC at STAR from 200 GeV Au+Au Data"
Kara Farnsworth*; Saskia Mioduszewski; Martin Codrington
The Shower Maximum Detector (SMD) in the Barrel Electromagnetic Calorimeter (BEMC) at STAR is used to improve the calorimeter's spatial resolution as well as π0 reconstruction, direct photon identification and electron identification. Using data from an Au+Au run at 200 GeV, which recorded the identification number and ADC value of each strip within the SMD, the detector can be calibrated. Since the data was zero suppressed, pedestal values from previous runs were used to make a pedestal subtraction. Once subtracted, an exponential could be fit to the remaining data. The constants of the exponential were normalized to each other, and the slopes from each were saved as the gains. These gains were then normalized by module and by detector, revealing a calibration constant. The calibrated data was then compared with the un-calibrated in relation to simulated data.

#26 "Reestablishing Precise 32Cl Branching Ratios"
Mark Hernberg*; Dan Melconian
We have determined the γ-ray branching ratios in the β⁺ decay of 32Cl using a high-purity Germanium (HPGe) detector at the Texas A&M University Cyclotron. Our experiment was motivated by a recent measurement of isospin symmetry breaking correction (δₒ) in 34Ar which has implications for the extraction of Vₑ₋ₐ from other superallowed decays. The experimental result for this superallowed decay [δₒ = (2.0 +/- 0.8)%] agrees with the theoretical predictions but is not a stringent test of theory. By measuring the γ-ray branching ratios in the β⁺ decay of 32Cl (a decay product of 32Ar) the detector efficiencies can be better determined allowing for a more precise determination of δₒ. Furthermore these branching ratios are important in the study of various nuclear decay schemes and transition rates. Previous measurements of the β⁺ decay of 32Cl are 35 years old and contain uncertainties of up to 40%. Our preliminary results agree with past data and additionally we've identified previously unseen branches and reduced the uncertainties by an order of magnitude.

#27 "Modern Energy Functional for Nuclei and Nuclear Matter"
Alberto Hinojosa*; Shalom Shlomo
We search for a modern energy density functional for nuclei and nuclear matter, based on the Skyrme type effective interaction. This interaction has been widely used for decades and many parameterizations have been realized to best reproduce binding energies, charge root mean square radii, and other properties of nuclei. Now that more experimental data is available, we are able to fit our results to a broader collection of nuclei at and far from the stability line. We implement the Simulated Annealing Method to search for the particular set of Skyrme parameters that best reproduces a collection of nuclear data. The data consist of binding energies, charge root mean square (rms) radii, rms radii for valence neutrons, spin-orbit splittings and breathing mode energies. The results we obtain using this new parameterization are in good agreement with a wide range of experimental measurements.

#28 "Probing 23% of the Universe at the Large Hadron Collider"
Will Hanagan*; Teruki Kamon

#29 "TBA"
Kenny Wunder*; Robert Tribble

#30 "Search for a Dark Matter Candidate at the Fermilab Tevatron"
Paul Geffert*; David Toback
Cosmological observations have shown that the amount of visible matter in the universe comprises only a fraction of the total mass of the current universe. Models of Supersymmetry can account for this mass by predicting new particles. We present a search for these particles in proton anti-proton collisions at the Fermilab Tevatron using a timing device on the Collider Detector at Fermilab and discuss work towards future searches into the cosmologically favored region of parameter space for models with heavy, long-lived neutralinos that decay into photons and gravitinos.
An experiment designed to determine the ground state spin and parity as well as the nuclear structure of the radioactive isotope $^{23}$Al is presented. By establishing a ground state spin of either $\frac{3}{2}$ or $\frac{5}{2}$, conclusions concerning the hypothesized proton-halo nuclear structure of $^{23}$Al are can be reached. Furthermore, an argument supporting symmetry between bound ground states of mirror nuclei is tested. Using careful consideration of gamma ray spectroscopy resulting from the decay of unstable $^{25}$Mg from the reaction $^{25}$Mg(p,$\gamma$)$^{23}$Al, the resulting momentum distributions yield a ground state spin of $\frac{5}{2}$$. This result determines that $^{23}$Al is not a proton-halo nucleus, but is consistent with previous experimental results strengthening the case for the use of mirror symmetry in nuclear astrophysics in systems otherwise not accessible.

Mutations in three p24 genes, including logjam (loj), eliminate egg laying. Previous experiments have shown that loj is required in the central nervous system (CNS) for egg laying to occur; however, we tested a subset of neurons to determine if loj expression in peptidergic neurons rescues egg laying. Expressing loj in the peptidergic neurons of loj mutants rescued egg laying.

To determine if other p24 genes are also involved in male or female reproductive behaviors, we used p24-RNAi alleles to reduce p24, either throughout the fly or solely in the CNS. We show that decreased function of some p24 genes affects female fertility by abolishing egg laying. We also provide evidence that p24 expression is needed for male fertility. Females mated to p24 deficient males lay eggs, but these eggs do not develop to the adult stage.

The purpose of this project was to determine a useful and promising software interface for the Texas Instruments TMS320C6711 DSP board for the purpose of engineering education, as well as develop DSP labs to elucidate concepts in digital filtering, audio and video processing. This was achieved through research of MATLAB, Simulink, and Code Composer Studio. Older projects were improved for development of an easy useful guide for students to become familiar with DSP concepts. The code to process signal effects, such as creating an equalizer, was built by MATLAB, with instruction from a Simulink model. This generated code was then loaded onto the DSP board. Using TRS connectors as input/output for real-time use, the code would affect discrete signals passing through the board. Real Time Data eXchange(RTDX) would then be used to link certain code with the board through a GUI, such as adding additional chorus or flanging effects, to allow ease of use and understanding. Later labs involve the processing of images from the computer through the board, for uses such as facial recognition. RTDX controls are used more often to control input and output of the board, due to the board being designed for audio processing. The results are labs designed for the purpose of teaching DSP concepts and models to allow students to understand the practice of these concepts. Projects and labs are better defined, easier to understand, and students will encounter less problems when working with the often troublesome connection between MATLAB/Simulink and Code Composer Studio.

A gap exists between the capability and efficiency of biological agents and autonomous robots. Swarms of programmable collaborative autonomous robots have applications in planetary exploration, search and rescue,
and surveillance. Our objective was to create an experimental test bed for a lightweight mobile robot with a high ratio of capability to efficiency. We aimed to transform a remote-controlled car into an autonomous mobile robot with target-seeking, obstacle-avoiding behavior. Throttle and steering servos in remote-controlled (RC) systems are motors controlled by pulse width modulation (PWM). PWM is the technique of varying the width of a square pulse of constant frequency to increase or decrease turning angle or linear velocity. We measured the pulse widths of control signals in a Team Losi Micro-T RC car. Then the signals from the remote control system of the car were replaced with an autonomous control system run by a Blackfin digital signal processor (DSP). We chose to generate these signals on the Blackfin using C-language programs. Additionally, to obtain obstacle-avoidance and target-seeking behavior, we interfaced a compass module, two ultrasonic range finders, and a tri-axis accelerometer with the Blackfin. In order to load programs to the system, we developed an infrastructure for communication between a computer and the Blackfin using a JTAG to USB connector. We built a robot that attempts to reach a predefined target vector. Upon sensing an obstacle, the robot moves to eliminate its presence while continuing to seek the target.

#35 "The Muslim Experience in the United States: An Examination of Racial and Religious Discrimination post 9/11"
Omar Kamran*; Rogelio Saenz

In the aftermath of the September 11th attacks, the passing of the Patriot Act, the war on terror, and an increase in deportation and detention of immigrants, the perception and treatment of Muslims has effectively racialized this relatively large portion of American citizens. The purpose of this project is to examine the ways in which Muslim Americans have been racialized pre and post 9/11. Through 18 semi-structured interviews with Muslim American students at a major university, I was able to gain insight into how Muslim Americans interpreted the events of 9/11, their perceptions of the media and government, and their personal experiences with discrimination. Interestingly, the data shows a sharp increase in criticism towards the media and government as well as in instances of discrimination after 9/11. Thus, the data have provided a unique opportunity to examine the particular means by which this heterogeneous group of American citizens has increasingly become racialized.

#36 "The Myths of Maternity: A Comparative Study of the Medical and Mythological Practices of Highland Tibetan Populations to Prove Cultural Adaptations to High-Altitude Hypoxia"
Stephanie Shively*; Sheela Athreya

This paper presents the physiological adaptations to high altitude present in Tibetan and Nepalese populations, and reviews the reviews the cultural practices surrounding childbirth which appear to have a connection to the stresses of hypoxic conditions. It concludes that the religious, secular, and folklore-related birthing rituals present in Tibetan and Nepalese society can be seen as cultural adaptations to high altitude stress. It expands the work of past studies, combining physiological and cultural research in order to argue the existence of a cooperation between environmental and cultural stresses. It goes on to show that the cultural rituals surrounding childbirth in Tibet and Nepal act to enhance the environmental stresses in order to weed out the less well adapted infants, speed up the return of the mother to reproduction, and mollify the dangerous aspects of the environment for those that survive. By doing so, the cultural rituals work with the environment in order to increase the occurrence of adaptations to high altitude stress.

#37 "Emerging Markets: Past, Present, Future"
Divya Srinivasan*; Julian Gaspar

To date, it has become quiet commonplace to do research on the expansion and evolution of the largest multinationals such as Exxon Mobile and General Electric in America. But time has told that these are not the only expanding multinationals, and definitely not the only highly influential ones impacting the world economy. India and China have undergone vast expansion and growth potential within a short time frame, which has a large part to do with emerging multinationals in these countries. So I would like to do a study of a developing countries' highly influential multinational, India's Tata Group, and do research on its potential and progress since its early nineteenth century beginnings. By explaining how India is taking a new lead in markets specifically through its' unique multinational strategies, I would like to prove the importance and power of emerging multinationals. If continued attention is not placed on these countries, America may be left behind as the developing underdogs make leaps and bounds toward capturing strength and lasting market power.
The Standard Template Adaptive Parallel Library (STAPL) is a superset of C++'s Standard Template Library (STL) which allows high-productivity parallel programming in both distributed and shared memory environments. This framework provides parallel equivalents of STL containers and algorithms enabling ease of development for parallel systems. In this paper, we will discuss our methodology for implementing a fast and efficient matrix multiplication algorithm in STAPL. Our implementation employs external linear algebra libraries, specifically the Basic Linear Algebra Subprograms (BLAS) library which includes highly optimized matrix operations. The paper will describe the benefits of creating a parallel matrix multiplication algorithm whose library calls are specialized based on both the matrix storage and traversal. This specialization technique ensures that the most appropriate implementation in terms of data access and structure will be used, resulting in increased efficiency compared to a non-specialized approach.

Many problems that cannot be solved directly on three-dimensional data are more easily addressed in the two-dimensional case. Cartographers, e.g., have long ago solved the problem of nautical navigation by finding ways to represent the Earth's surface in a flat plane, where angles and areas could be measured directly by a ship's navigator. Likewise, problems such as texture mapping and remeshing in computer graphics are easier handled by flattening a representation of a surface into a plane. This work seeks to extend one of these methods, namely Least Squares Conformal Mapping, (or LSCM), to more robustly handle error introduced by varying triangle size in the mesh. A mesh is appropriately cut into charts homeomorphic to a disc. Each chart is then fed into our algorithm, where the faces undergo a roughly conformal transformation into the UV plane. This result is then fed back into our algorithm recursively until a depth limit is reached, each time adjusting the error metric to compensate for the previous pass's weighting of triangle areas. The effects of using different error metrics are explored. Applications and benefits to quadrilateral remeshing are also studied.

This research sought ways to successfully navigate a large volumetric Dataset of images obtained from the Knife-Edge Scanning Microscope. The KESM produces over 60,000 raw images each roughly 47mb large for a total data size close to 2TB. The limitations of the end-user's connection and hardware and the limitations posed on the server hosting the data necessitated the use of a lightweight web interface for viewing. Given the volumetric nature of the data, this viewer also needed to be implemented with pseudo-3D rendering while still maintaining its lightweight characteristics. To accomplish these goals, an XML database of a compressed set of the data was generated, along with indexing the filenames in a way which represented their relative position. With the XML database and the filenames providing a computationally cheap representation of the position of each image, stereoimaging was used to render the images in a way which the human visual system perceives as 3D. Depth, binocular disparity and distance attenuation were implemented in simple Javascript, CSS and HTML to maintain the lightweight nature of the viewer. From the implementation created through this research, we were able to determine that we can dynamically showcase volumetric data in a way that the human visual system perceives as 3D by mimicking depth, binocular disparity and distance attenuation through a computationally cheap web interface.

The TamuBot platform is a robust, easily upgradeable mobile robotic platform for research. The TamuBot platform and its control system are designed for real-time user interaction, real-time sensor feedback and multiple networked robotics. We will discuss the integration of two types of inertia measurement units (IMU), Sentra Technology's IMU605 and Microstrain's 3DM-GXI. To achieve real-time sensor feedback and the flexibility desired, we implemented a multi-threaded event-driven design. This design allows for the synchronization of the two IMU which have different frequencies and communication protocols. This design also lends itself to easy integration of future sensors such as global positioning system (GPS) and networked video cameras. Furthermore, we will describe the serial port communication and settings for both IMU. We will also discuss the process taken to convert existing Linux and Windows compatible code for use on this embedded system.
# 42 "SOUSA: The Sketch-Based Online User Study Application"
Emily Jacobson*; Brandon Kuster*; Tracy Hammond
We have developed an interface for the Sketch-Based Online User Study Application (SOUSA), the purpose of which is to create a universal, standardized set of sketch data. This online interface will make sketch data collection more efficient for researchers and more accessible to a general audience. The expected contribution of our work will be an increase in participation of researchers and practitioners in the field of sketch recognition; thus developing a large, robust repository of sketch data. A motivating factor behind our work is to allow sketch recognition researchers to focus on higher-level tasks, rather than data collection. Features of our interface include a standardized collection mechanism and set of sketch data which will allow new sketch recognition algorithms to be more easily compared with existing models. Our new interface will allow researchers to download their own, as well as other publically available, data gathered from collection and verification studies. This new interface will be hosted by the Sketch Recognition Laboratory at Texas A&M University, providing researchers a single, unified solution for sketch data collection and management.

# 43 "Comparison of Preconditioners"
Shane Strasser*; Vivek Sarin
With the introduction of more advanced preconditioners, iterative methods have become more competitive with direct solvers in solving systems of large, sparse linear equations. In this study, three types of preconditioners were implemented to determine the most effective preconditioner for matrices arising from the finite difference discretization of the Poisson equation with Dirichlet boundary conditions. The three types of preconditioners studied were diagonal matrices, incomplete factorization with no-fill in and support graphs. Support graph preconditioners for n by n matrices were constructed using a parameter value of $t = n^{1/4}$, where $t$ the number of sub-trees the support graph is partitioned into during its construction. All comparisons were against the non-preconditioned conjugate gradient method. Results for the diagonal preconditioner showed no change in the number of iterations while incomplete factorization with zero level of fill-in saw a decrease in the number of iterations as large as 37.5%. Support graph saw a decrease as large as 14.9% and an increase up to 11.3% in the number of iterations. This is due to the choice of the parameter $t$ during the construction of the preconditioner and further work is needed in determining the optimal number of sub-trees.

# 44 "Hole Detection in Wireless Sensor Networks"
Lauren Cassidy*; Jianer Chen; Fenghui Zhang
The detection of holes in sensor networks can provide useful information about the physical environment in which the sensors are located. It can be used to understand environments and events such as a fire in a forest. While previous approaches involve either planarizing or embedding the network, we propose a new technique that discovers these holes in a very direct manner. The algorithm detects the holes without any knowledge of the nodes locations and is based on the idea that the cycles created by the holes are simple cycles without chords. These are referred to as a minimal cycles. The algorithm created is polynomial running in approximately $O(n^{5/2})$, and returns the path of the nodes around the largest hole as well as the length.

# 45 "Faster HTML Link Extraction for Webcrawlers"
Drew Fisher*; Dimitri Loguinov
This paper shares my experience in designing an HTML parser specialized to find and extract links from billions of pages in real time for a large-scale webcrawler. Standard parsing methods to build a DOM tree are too slow to scale for the purposes of realtime high-performance webcrawling. Further, many webpages are poorly designed, so a replacement parser should also be robust and able to find links in such pages. I analyze a 6 TB snapshot of the Internet from the IRLbot project for HTML coding errors and benchmark several HTML parsers with respect to time taken to parse the pages and accuracy. I describe techniques to maximize speed while achieving acceptable robustness, and implement them in my own parser, which compares favorably to the benchmarked HTML parsers. This code may be integrated into future revisions of IRLbot, our scalable webcrawler project.

# 46 "Articulated Human Motion Capture"
Zhao Lin*; Jing Xiang Chai
The purpose of this report is to describe the whole process from capturing of articulated human motion data to playback of the motion on a human character. The report is organized into three major sections. The first section introduces the general theory of capturing human motion by using Vicon system. The second section explains in
detail representation of captured human motion data, including the data fields and structures of the generated skeleton and motion files. The third section explores the way to build up the skeleton for a human character and use the captured motion data to drive the character.

# 47  "Registration and Labeling of Mouse Brain Atlases using Free-form"
  Kacra Manavi*; John Keyser; Yoonsuck Choe

The mammalian cerebral cortex has the potential to transform computing, having applications in topics such as parallel and distributed systems and computation. However, it is still unclear how exactly a system as complex as the cerebral cortex functions. Existing mouse cerebral cortex atlases based off of low resolution data have been labeled extensively. High resolution atlas data gives researchers a better tool, necessary for understanding the workings of the cerebral cortex. The intent of this research is to correlate existing mouse brain atlases with newer, more detailed mouse brain atlas data. New data acquired by use of the knife-edge scanning microscope (KESM) is very high resolution. This new KESM data based atlas will be down sampled and by use of free form deformation fit to existing mouse brain atlases. The inverse function of this deformation can then be used to map the existing atlas labeling schemes to the KESM atlas, reducing the amount of brute force labeling necessary. Down sampling the KESM data to an appropriate format is complete and has been rendered in conjunction with the software package SHIVA 2. Free form deformation of the data set is still in progress. Once this has been completed, the inverse of the deformation can be calculated and the research will be complete.

# 48  "Wireless Communication System for TAMU Bot Robotic Research Platform"
  Tyler J. Southard*; Dezhen Song

The TAMU Bot is a mobile robot designed for the purpose of providing a flexible and cost-effective platform for robotics research. I developed a software package to facilitate cross-platform, streaming, TCP/IP socket communication between a Windows PC and the Linux-based TAMU Bot robot. Previous iterations of the TAMU Bot facilitated local sensor data storage only, which prohibited efficient experimentation procedures and data acquisition. The new software package allows the robot to wirelessly communicate all sensor data to a remote machine as well as receive control input from the server. The client software is flexible in its ability to eventually support as many sensors as the given network will support. The server software is also flexible by eventually allowing multiple robots to be monitored and controlled concurrently. The server is implemented as an MFC application. Combined with the threaded client software, wireless data acquisition and control is achieved. Through the development process, I spent time learning about MFC programming, socket programming, pthreads, and serial port interfacing. These are invaluable development skills for future work.

# 49  "Performance Analysis of a Computational Biology Code"
  Timothy Campbell*; Valerie Taylor; Xingfu Wu

The current trend in parallel computing systems is shifting towards cluster systems with CMPs (chip multiprocessors). Further, the CMPs are usually configured hierarchically (e.g., multiple CMPs compose a multi-chip module and multiple multi-chip modules compose a node) to compose a node of the parallel system. A major challenge to be addressed is efficient use of such cluster systems for large-scale scientific applications. In this research, we analyze the performance of a computational biology code MrBayes on two supercomputers: DataStar p655 at San Diego Supercomputer Center (SDSC) and Hydra at Texas A&M Supercomputing Facilities, and quantify the performance gap resulting from using different number of processors per node. We use PAIDE to instrument the source code of MrBayes to collect the performance, upload the performance data to Prophesy database, then use Prophesy system to model the performance online.

# 50  "Performance Analysis and Comparison of MPI, OpenMP and Hybrid NPB-MZ"
  Hector J. Machin*; Valerie Taylor; Xingfu Wu

Chip multiprocessors (CMP) are widely used for high performance computing and are being configured in a hierarchical manner to compose a node in a parallel system. CMP clusters provide a natural programming paradigm for hybrid programs. Can current hybrid parallel programming paradigms such as hybrid MPI/OpenMP efficiently exploit the potential offered by such CMP clusters? In this research, with increasing the number of processors and problem sizes, we systematically analyze and compare the performance of MPI, OpenMP and hybrid NAS Parallel Benchmark Multi-Zone (NPB-MZ) on two supercomputers: DataStar p655 at San Diego Supercomputer (SDSC) and Hydra at Texas A&M Supercomputing Facilities to address the question. We also upload the performance data of NPB-MZ to Prophesy database and use Prophesy system to model the performance online.
# 51  "Traversing Surfaces using Two Module Bridges of Hexagonal Self-Reconfigurable Metamorphic Robots"
Isaac Krull*, Jennifer Walter

This paper presents algorithms to plan the concurrent and collision-free movement of \( n \) hexagonal metamorphic robots (modules) using two module bridges over a contiguous surface in a hexagonal grid. These algorithms calculate the location of cells that can be used to bridge "non-concurrently traversable" segments, where narrow passages between surface cells may result in module collision. Our bridging algorithms use changes of direction to avoid modules becoming deadlocked and to maintain optimal spacing between modules throughout the traversal. This process is divided into two phases: a centralized planning phase and a distributed reconfiguration phase, in which modules only require local information to determine rotation direction. Specifically, we examine the cases where the bridge will only be two modules long and demonstrate that by carefully placing these bridges, we will not generate any new non-concurrently traversable segments. We also developed a classification system to identify the three distinct types of pocket openings to determine which algorithm to use. In addition, we present the results of simulating our algorithms using a discrete event simulator.

# 52  "Using a Pocket-Filling Strategy for Distributed Reconfiguration of a System of Hexagonal Metamorphic Robots in an Obstacle-Cluttered Environment"
Stephen Matysik*, Jennifer Walter

We address the problem of reconfiguration planning for a metamorphic system of a large number of connected hexagonal mobile robots. Our goal is to find an algorithm that will plan the concurrent movement of individual robots, from an initial configuration \( I \) to a goal configuration \( G \), when \( G \) contains one or more clusters of obstacle cells. Since our past work produced a reliable and efficient algorithm for filling an obstacle pocket, our approach is to force any given \( G \) to be an obstacle pocket, by filling the boundary cells of \( G \). Then, we adapt the pocket-filling algorithm to handle obstacles within the pocket. We designed a two-phase algorithm, which has a centralized planning phase followed by a distributed reconfiguration phase, in which no inter-module message passing is required. The resulting algorithm reliably envelops multiple obstacles and fills an admissible goal configuration while eliminating the risk of module collision or deadlock. We have tested the algorithm with a discrete events simulator and every admissible goal configuration tested was filled successfully.

# 53  "Nearest Neighbor Search In Motion-Planning"
B. Lakshmi Reddy*, Nancy Amato

Nearest Neighbor Search plays a vital role in building road-maps in Motion Planning. These are implemented in any Road-map building method such as PRM, OBPRM, Gauss PRM, etc. Motion Planning is the science of designing a successfully implementable plan in any Configuration Space (often called C-space) in order to move the Robot from given a Start Configuration to a Goal Configuration by avoiding collisions with obstacles lying in the C-space. Obstacles can be either static or dynamic. In this process of building Road-maps, Node-generator randomly generate the nodes throughout the C-space wherein each node represents the possible position of the Robot that might be attained while in motion. From all the above nodes generated by Node-generator, Road-map stores the portion of the nodes that are free from possible collisions which is determined by Collision-detection-test. One such Collision-detection-test that is currently used is 'RAPID'. The nodes stored in the Road-map are connected using Local-planner such as Straight-line, Rotate_AT_S, etc... Nearest Neighbor Search problem comes here where this paper focused towards after serious investigation of various environments and each environment was investigated by varying number of Nearest-neighbors (K), number of Nodes(N) and Epsilon. Investigation into various environments by variation of K, N and Epsilon over a wide range can help in finding suitable K, N and Epsilon values that could optimize the total time to build the Road-map. This process has the possibility to save time in construction of suitable road-maps. After finding the nearest neighbors for each node in the C-space for a given K, N and N, the Local-planner helps connect each node in the given C-space to its nearest neighbor in order to build a fast and efficient road-map. Thus far, I have investigated Hook and Maze environments using Brute-Force, CGAL and MPNN Neighborhood Finders by varying K from 1 to 128, N from 1000 to 20000, and Epsilon from 0.0 to 3.2 in order to calculate appropriate values for K, N and Epsilon to build effective and quality Road-map.
# 54 “It's a Coyote Eat Deer feed Tick World: a Deterministic Model of Predator-Prey-Parasite Interaction in the Northeast”
Orianna DeMasi*; Kathy Li*; Yuliya Gorb; Jay Walton

Occurrences of Lyme Disease have drastically increased since the advent of the disease in the 1970’s. Currently much research focuses on controlling Lyme through ticks, the vector for the disease. Ticks feed on White Tailed Deer which have recently reached surprisingly high numbers in the Northeast. It is thought that reducing deer populations will effectively decrease tick populations and thus the threat of Lyme. Consequently many towns have considered or begun implementing ambitious deer culling programs. Coyotes have recently migrated into the Northeast from the Plains. It is thought that coyotes, who prey on deer, may have been attracted by the abundant prey supply. It is questioned whether the coyotes will act to replace the wolf as a natural control on deer population. We constructed a deterministic model to represent the current deer and coyote population dynamics and used this model to investigate the long term interaction of coyotes and deer. Further, we explored the potential for coyotes to act as a biological control on the deer populations and aid deer culling programs. The model and predictions for both populations were checked against estimates found in the literature and it was found that significant human intervention would be needed to successfully control deer. Numerical simulations of the model and possible culling programs are provided to help highlight the system dynamics and guide culling policies.

# 55 “Rotordynamics of Foil Bearing Supported High Speed Rotors”
Kathleen Hagen*; Luis San Andrés

Commercial microturbomachinery (MTM) used for distributed power generation implements gas foil bearings due to their nearly friction-free operation, ability to operate at high temperatures, and tolerance to static and dynamic loads. The load capacity of a foil bearing depends mainly on the resilience of its support structure with mechanical energy dissipation from material damping. The foil bearing structure is highly nonlinear and exhibits hardening characteristics as rotor displacements become large. For operation at rotor speeds well above the system critical speed, the bearings' nonlinearity determines multiple frequency rotor motions with large whirl amplitudes at the system natural frequency. The large motions impair the efficiency and reduce the reliability of the MTM. A simple structural model for the foil bearings integrated into a Finite Elements rotordynamics computational program is used to predict the time response of a test rotor supported on gas foil bearings for a number of imbalance conditions replicating actual experiments. The numerical predictions correlate favorably with the measurements, revealing a complex rotor response rich in subsynchronous motions yet rotordynamically stable. In general, the larger rotor imbalances exacerbate both the amplitudes of synchronous and subsynchronous motions, while the smaller mass imbalances induce a rotor response similar to that of a linear system.

# 56 “Measurements of Rotor Lift Off and Break Up Torque in a Metal Mesh Foil Bearing for Use in Automotive Turbochargers”
Brian Rice*; Luis San Andrés; Keun Ryu; Thomas Chirathadam

Gas bearings enable the commercial success of high speed microturbomachinery operating at high temperatures and virtually friction free. Metal mesh foil gas bearings are a low cost alternative to replace oil-lubricated bearings in passenger vehicle turbochargers. However, during rotor start up and shut down, the rotor operates in contact with the foil bearings thus demanding of a large break up torque to overcome the dry-friction. Early rotor lift-off in the bearings enables nearly friction free operation. Measurements of break up torque on a metal mesh bearing as a function of shaft speed and static load are obtained in an existing turbocharger driven test rig. Bearing performance characteristics such as power loss and ultimate load capacity are experimentally determined. The bearing experiences the highest torque at low shaft speeds, dropping significantly once the rotor lifts off. Increases in static load lead to an increase in bearing break up torque and delay rotor lift off to a higher speed.

# 57 “Micromachining of Stainless Steel”
A. Palocaren*; S. Chittipolu; W. Hung

The 316L stainless steel is commonly used for medical, biological, or turbomachinery applications. The increase of customer demands drives the need for producing miniature products with micro-scale components. Micromachining of 316L stainless steel, however, is difficult due to premature tool failure and unpredictable tool life of the fragile cutting tools. The objective of this research is to establish a procedure to predict possible machining conditions that will cause catastrophic tool failure. Finite element technique is used to model and predict machining stresses on a micro cutting tool. Breaking forces and critical stresses are calculated from actual tests of miniature tools performing at different conditions. The results are compared and thresholds for tool failure
are established to make micromachining of 316L stainless steel and other superalloys an economically accepted process.

# 58 “Control of Electrochemical Microsystem”
J. Soule*; L. Calhoun; J. Ozkernski; S. Sundaram; W. Hung

Turbo machinery utilizes high performance superalloys for system structure due to high stress and high temperature environment. Although having superior mechanical and metallurgical properties, superalloys are difficult to be machined using conventional methods. The problem is even more challenging when microcomponents are required for micro turbomachinery. Electrochemical micromachining (μECM) removes a minute amount of material using Faraday’s principle in electrochemistry. The technology is suitable for mass fabrication of intricate micro/nano features on superalloys. The objective of this project is to investigate different control schemes for an ECM microsystem. Performance of the open-loop versus closed-loop systems using position and current feedbacks are compared. Microfeatures on 316L stainless steel are fabricated and measured. Productivity, cost, and accuracy are used as evaluation criteria.

# 59 “Precision Tooling for Manufacturing of an Underspring for a Generation II Gas Foil Bearing”
Nick Niedbalski*; Tae Ho Kim; Michael Johnson

Gas foil bearings (GFBs) have enabled commercially successful microturbomachinery for distributed power generation. With rotor spinning, the compliant surface of a GFB retracts to generate a gas film that supports the rotor load with nearly friction free operation. The bearing elastic structure or underspring is composed of a metal foil strip with preformed bumps, whose stiffness determines the overall bearing resilience. Inaccurate manufacturing methods create great variations in bumps’ stiffnesses which ultimately affect GFB performance. This project aims to design and construct a tooling set for manufacturing of corrugated bump strip layers for use as undersprings in GFBs. A manufacturing process detailed in the open literature is retaken. Upper and lower bump press dies are wire EDM (Electrical Discharge machining) with a maximum tolerance < 20 μm. A CNC machine precisely builds upper and lower die beds. With alignment pins, the die beds holding the bump press dies ensure accurate alignment when press forming bump strip layers. A simple static load – deflection test aids to estimate the stiffness of the manufactured bump strip layer. Test data are compared to model predictions based on engineering elasticity formulas.

# 60 “Optimal Micromist for Effective Micromachining”
S. Adería*; S. Chittipolu; W. Hung

Turbo machinery must use superalloy microcomponents because of high stress and temperature. A superalloy possesses superior mechanical and metallurgical properties, but poor machining properties. Although various nontraditional techniques have been used successfully for superalloy microcomponents, current design of turbomachinery still requires some microcomponents to be manufactured by conventional machining techniques. However, frequent breakage of microtools during machining of superalloys is a concern. A novel technique to reduce machining stress and eliminate tool breakage must be developed. This study characterizes a micromist system and optimizes it using statistical approach in engineering experiments. The effectiveness of micromist is demonstrated with actual machining study. Model of how microdroplets flow and adhere to a rapid rotating tool is developed and compared with experimental data.

# 61 “High Frequency Electrochemical Micromachining”
L. Calhoun*; J. Linnell; S. Sriharsha; J.M. Ozkern; W. Hung

Electrochemical micromachining (μECM) removes a material in micro/nano scale according to Faraday’s principle in electrochemistry. The technology is suitable for mass production of intricate micro/nano features on superalloys for micro turbomachinery applications. Significant improvement can be made by applying pulsed voltage/current to an ECM cell instead of a direct current as in Faraday’s law. Electrode shape can be preserved and diffusion of ions away from the anodic workpiece can be improved under pulsed current. High frequency, however, would reduce the ionization time, therefore, material removal rate of the process. This study quantifies the effect of frequency – from few hertz to megahertz – on microfeature quality and system productivity. A theoretical model for material removal rate will be developed and evaluated with experimental data for 316L stainless steel.
Use of Gal4-Mos1 and Gal4-PiggyBac Chimeric Transposases For Germ-line Transformation in Drosophila Melanogaster
G. M. Villegas III*; L. S. Bales; K. J. Maragathavally; C. J. Coates

Mosquitoes transmit diseases such as malaria, dengue fever, and West Nile Virus. Genetic transformation of mosquitoes is essential to control disease transmission through insects. Genetic transformation systems based on mariner and piggyBac transposable elements are successful in a variety of species, however low transformation efficiency and low transgene expression levels result due to random integrations in the genome. We developed a novel technology that utilizes a chimeric transposase to achieve targeted integration. The Gal4 DNA binding domain (DBD) was fused to the N-terminus of the mariner and piggyBac transposase coding regions and a target plasmid was created that contained upstream activating sequences (UAS), to which Gal4 DBD binds with high affinity. The piggyBac helper plasmid with Gal4 DNA binding domain along with piggyBac donor plasmid (pBac[3xP3-EGFPafm]) are injected into embryos of transgenic Drosophila melanogaster line UASLeoII#202 SA 126 9/2 which has UAS sites on chromosome 3. Injected embryos gave G0 generation. Each putative male and female fly is crossed with two non-transgenic females and three non-transgenic males respectively. EGFP expression with 3xP3 promoter can be used for initial screening using UV microscope. Through a variety of genetic manipulative techniques like DNA isolation, inverse-PCR, sequencing are used to determine transgene integration into the Drosophila genomic DNA. Finally I will analyze to see whether site-specific integration occurred near UAS site, which has been integrated with P-element and verify how close is the insertion to the UAS site.

Usage of Chimeric piggyBac transposases in site-directed integration
L. S. Bales*; G. M. Villegas; K. J. Maragathavally; C. J. Coates

Genetic transformation of mosquitoes is essential to control disease transmission. PiggyBac transposable elements have been used to transform insects with transgenes, that are able to control disease transmission through insects. Even there is enormous success with transposable elements there are problems such as low transformation efficiency and low transgene expression levels. PiggyBac transposable elements inserts transgenes at TTAA sites in the genome, 4bp sequence, which results in random integrations, causing decreased fitness, mutagenesis, over-expression, or gene silencing. To resolve this problem we are trying to use site-specific integration technology which has the potential to minimizes nonspecific integrations events. Transpositional assays have been used to verify the helper plasmid efficiency to insert transgenes from donor plasmid into the target plasmid. PGDV1 target plasmid is injected into the embryo, along with piggyBac Koa donor plasmid (pKan-ori), and piggyBac helper plasmid with the GATA DNA binding domain (DBD). In the transposition assay, helper plasmid helps to insert the transposon into the target. Transposition products will be selected based on triple selection using kanmycin, chloramphenicol resistant genes and E.coli trasformation. Technically E.coli ori and kanmycin resistant genes will transpose from donor plasmid into the target where chloramphenicol resistance gene is present. Analysis of transposition products will be preformed with BamH1 digestion and DNA sequence analysis. Once transposition assays result in high transformation efficiency, the plasmids can be used to generate transgenic insects. This technology can be used to achieve site-specific integration which will help to insert gene at specific site and increase transformation efficiency.

Amblyomma Americanum Tick Chitinases: A Molecular and Biological Characterization
Jeanette Curran*; Albert Mulenga

Two cDNAs encoding a long (L) and short (S) form of an acidic chitinase (Achit) were discovered among cDNAs of mRNAs that were up regulated in Amblyomma americanum that were stimulated to start feeding. Rapid amplification of cDNA ends was used to amplify and clone full-length cDNAs whose differences are restricted to the amino terminal end and a 200-nucleotide deletion in the central domain of the S Achit. The purpose of this study was: 1) to validate the expression of L Achit and S Achit transcripts during tick feeding 2) to correlate the expression patterns of L Achit and S Achit with tick feeding activities during the preparatory and slow feeding phase and, 3) to express recombinant L Achit and S Achit. Utilizing specific primers for L Achit and S Achit, we have shown that both transcripts are expressed in unfed and partially fed ticks with the transcript abundance of L Achit being ~two fold higher. Experiments to express recombinant proteins, and determine the temporal and spatial expression patterns of L Achit and S Achit mRNA in salivary glands (SG), midguts (MG), ovary (OV) of ticks that fed for 24 through 168 hrs are ongoing.
Blow flies (Diptera: Calliphoridae) are the most significant insects in death investigations because known patterns of larval development allow entomologists to determine how long a corpse has been colonized (Catts & Goff 1992). Generally, blowflies do not colonize a body until death has occurred. Therefore the length of time of colonization can be assumed to be the minimum PMI. In this study, colonies of Cochliomyia macellaria (Fabricius) and Chrysomya rufifacies (Macquart) were reared under eight separate diet regimens to compare the effects of quality, timing, and sterility of protein available to the flies on ovarian development. All conditions were given non-sterile liver as an ovipositional site on days 10 through 15, and the experiment ended after Day 15. In order to determine ovarian development, 20 females from each condition were euthanized on Days 5, 7, and 10; the stage of ovarian development was determined by dissection. Advanced ovarian development was found to predict oviposition. Female C. macellaria and Ch. rufifacies require a quality protein meal before ovarian development can be completed, with oviposition occurring in C. macellaria on Day 5, and Ch. rufifacies on Day 6. The need for a protein meal several days before oviposition can occur may explain why blow flies will occasionally arrive at a death scene a significant time before oviposition begins. By improving knowledge of the pre-colonization interval (pre-CI) of insect infestations on corpses, the accuracy of postmortem interval (PMI) estimates can be improved.

Host-associated differentiation is a mechanism that may promote species diversity by genetically isolating subpopulations within a species that is adapting to new hosts. HAD presents a challenge that growers must recognize and address. If biological control is to succeed one need to take into account the ways in which pest species adapt to genetically different host-plant species. Several studies have found host-associated genetic differences in herbivorous insects on multiple host-plant species in forests and natural ecosystems. In contrast, there are fewer examples of HAD among insects that feed on different cultivated host-plant species. Examples of HAD in agriculture could be limited to native crop-native pest interactions because HAD seems to require a native system in which species co-evolve over thousands of years before differentiation can be expressed. The cranberry fruitworm has been a pest of and co-evolved with both cranberries and blueberries for millennia in its native habitat. Thus, we test the cranberry fruitworm, Acrobasis vaccinii Riley (Lepidoptera: Pyralidae), for HAD by comparing the genetic characteristics of individuals associated with cranberry, Vaccinium macrocarpon, compared to those living on blueberry, Vaccinium corymbosum. We collected samples from both blueberries and cranberries throughout various farms across New Jersey. We extracted the samples’ DNA using the QIAGEN DNeasy Blood & Tissue Kit. Amplification fragment length polymorphism (AFLP) markers were developed to assess the role time plays in the occurrence of HAD. We expect to detect HAD in the native A. vaccinii on two of its native host-plant species.

The biological role of calcitonin receptor-like receptors, a type of G-protein coupled receptors (GPCRs), in maintenance of water balance in mosquitoes of Aedes aegypti (L.) (Diptera: Culicidae) is being studied. In Anopheles gambiae, the Angoga-DH31 receptor (a calcitonin receptor-like receptor, AaegGPRCal3), is known to function in maintenance of water balance, as it is responsible for sodium excretion in Malpighian tubules post blood feeding. The presence of receptors involved in water balance has also been confirmed in the central nervous system and other peripheral tissues in insects. This project focuses on the Calcitonin 3 (AaegGPRCal3) GPCR, another sub-type in the family :B of GPCRs. Cloning of the Cal3 GPCR was attempted from RLM cDNA prepared various tissues extracted from females of A. aegypti, a vector of the pathogens causative of yellow fever and dengue fever. The cloned fragments were sequenced and the complete sequence of the open reading frame (ORF) and 5' and 3' untranslated regions (UTRs) was obtained. Alignment of these sequences with the predicted genomic sequence (gene ID: AAEL009024; vectorbase.org) showed an exact match of 289 amino acids in the middle of the ORF, but an entirely different sequence at the ORF 5' end and an additional 36 amino acids at the 3' end of the ORF. These results demonstrate that experimental validation of predicted sequences is necessary before attempting other genetic studies of these important GPCRs.
Among insects, differences in morphological, physiological and life history traits may require intake of dietary macronutrients (proteins and carbohydrates) at disparate levels. Active regulation of these resources may be necessary if natural diets are imbalanced in macronutrient content. The polymorphic cricket, Gryllus sp., differ morphologically as short and long-winged morphs, being flightless and flight capable, respectively. Additionally, short-winged morphs are observed to have increased ovarian mass. Accompanying these morphological and life history differences, morphs are likely divergent in their regulation and physiological requirements for macronutrients. Here, we studied macronutrient regulation in Gryllus sp. by providing individuals with one of five different choice treatments, or one of two non-choice treatments, each treatment containing different percentages of macronutrients. Results of the choice treatments provide the intake target for each morph. Results of the no choice treatment indicate that long-winged individuals are willing to consume carbohydrates in excess in order to reach a preferred protein intake target. In contrast, short-winged individuals consume only a certain amount of a given resource to reach a protein intake target without consuming excess carbohydrates. The flight capable morph has the ability to utilize the excess carbohydrates, whereas the alternate morph does not and must insure its ability to properly use the obtained nutrients. Results indicate that given a suite of morphological, physiological and life history traits, insects can regulate intake of a required macronutrient to optimize performance and/or potential lifetime fitness.

This study sought to gain a better understanding of factors that affect the period of insect activity (PIA). Knowing the behavior of these flies can help build a more accurate estimate of the time a body has been exposed to insect activity. Three Y-tube olfactometer bioassays were performed to study the attraction or repulsion effects of different liver resources on Coeliohymia macellaria (Fabricius) and Chrysomya rufifacies (Macquart). Both species were given the choice between fresh liver and 3-d old liver to determine resource preference. Fresh and aged liver was sterilized by autoclaving and both species were presented with the choice between non-sterile liver and sterile liver of the same age. This test examined the effect that bacteria growing on a resource had on fly attraction. Bacteria obtained by swabbing fresh liver were grown on sterile nutrient agar for either one or three days. Flies were tested for preference between bacterially-treated and sterile agar. This final test determined the effect that bacterial odors had on fly choice without the influence of odors from the tissue. For each trial, initial response, response after 5 minutes, and time spent on each resource were recorded. Chi-square analysis of response after 5 minutes showed that C. macellaria significantly preferred fresh resource while C. rufifacies showed a preference for 3 d old liver. There was no significant difference in preference in either species for sterile or non-sterile liver based on either initial response or response after five minutes. The results obtained help confirm assumptions that C. macellaria is a primary colonizer while C. rufifacies acts as a secondary colonizer.

The oil supplies of the world are decreasing while the cost of oil continues to increase. The need for an alternative source of energy is urgent. One possible alternative energy source is biofuels from oleaginous microbes. Oleaginous microbes accumulate oil at concentrations greater than 25% of their mass. Oil accumulation in oleaginous microbes occurs within the cell. Therefore recovery of the fuel is one barrier which must be overcome. Our novel approach involves engineering a proprietary microbe to autolyse upon temperature stress. I mutagenized the microbe with 254 nm wavelength ultraviolet light and implemented a screen for autolytic mutants. To facilitate downstream genetic engineering of the microbe, I am also screening for auxotrophic mutants on selective media. An auxotrophic microbe is unable to manufacture a specific nutrient, and therefore must be supplemented. Possible mutants were replicated onto a numbered grid on selective media and a temperature stress plate. I screened for pyrimidine and adenine auxotrophs. We used 32°C as our restrictive temperature stress point to identify autolysis mutants. Any colonies that showed reduced growth on one type of medium were rescreened. To date, I have screened approximately 4040 potential mutants and rescreened 406 mutants that showed minimal growth. To further the development of the biotechnology platform of the organism, I researched ascospore formation of the microbe which will facilitate genetic recombination.
"Microdiesel's potential for sustainable production of biofuels"
Paul de Figueiredo; Lei Li; Oscar Sosa*

Research focuses on neutral lipid accumulation in a proprietary oleaginous yeast, the Microdiesel platform. Potential of this yeast for biofuel production is based on high content of triacylglycerol, its predominant neutral lipid, whose fatty acyl chains are chemically similar to hydrocarbons present in commercial fuels. Extraction of neutral lipids and thin layer chromatography were used to assess triacylglycerol content in the organism. Future large scale cultivation of the Microdiesel yeast may be a critical component of successful biofuel production.

"Functional Analysis of the Gene Cluster Encoding Gliotoxin in Trichoderma virens"
David A. Laughton*; Walter A. Vargas; Prasun Mukherjee; Charles M. Kenerley

Trichoderma virens, an avirulent symbiont that colonizes numerous plant species, is used as a biocontrol agent, and secretes many secondary metabolites, including gliotoxin, an important virulence factor in other fungi. T. virens genome displays a gene cluster similar to the one described in Aspergillus fumigatus for the biosynthesis of gliotoxin. Northern blot experiments demonstrated that in T. virens the expression of the gene cluster is co-regulated and correlated with gliotoxin production. The mutagenesis of a gene within the cluster encoding a non-ribosomal peptide synthetase, GIIP, resulted in the loss of gliotoxin production in the mutant strains (DGII). Wild-type and mutant strains were assessed for colonization of maize roots, biocontrol ability against the plant pathogens Pythium ultimum and Rhizoctonia solani and colony growth under oxidative stress. We demonstrate that gliotoxin production in T. virens is important for fungal growth and development. The DGII strain grew significantly faster than the wild-type with a distinctive difference in hyphal pattern. Contrastingly, oxidative stress experiments showed that DGII and wild-type strains similarly in the presence of 10 mM H2O2. These results suggest that in T. virens, gliotoxin is involved in oxidative processes that control cell proliferation and hyphal growth. In T. virens gliotoxin production is not essential for biocontrol ability, but seems involved in the control of root colonization of maize plants. These results describe for the first time the functional characterization of GIIP and investigate the role of gliotoxin in the non-pathogenic fungus, T. virens.

"Establishing physiological and biochemical function of selected lipoxygenase genes"
Eli Borrego*; Chestley Miller; Shawn Christensen; Michael Kolomiets

Lipoxygenases are a family of enzymes which oxygenate unsaturated fatty acids to yield hydroperoxy fatty acids. These are known as oxylipins and are important substrates that are further metabolized by plants to yield bioactive chemicals used for disease and stress responses. Zea mays has a slightly larger number of lipoxygenase (LOX) genes compared to other plants and by investigating LOX mutants through abiotic and biotic stresses it is possible to establish the function of these genes in the role of plant defense and plant development. Mutants were developed using a reverse genetics approach to identify individuals which have a transposable element mutator inserted into the LOX genes. Identified mutants were subsequently backcrossed over several generations into an established inbred line to remove mutator insertions elsewhere in the genome. The focus of this study was to elucidate the function of ZmLOX7, ZmLOX8, and ZmLOX10. In order to do this, several hypothesis driven experiments were run, namely: (1) To understand the role of LOX10 genes in the biosynthesis of jasmonic acid, wild-type and mutant plants were exposed to green leafy volatiles (GLVs) under different durations. Reverse-transcription PCR of OPR (oxophytodienoate reductases) 7 and 8 was preformed. (2) Wild-type, LOX7 mutants, and LOX8 mutants were inoculated with root-knot nematodes (Meloidogyne). Eggs were harvested and counted to determine susceptibility to infestation. RRPCR results show that LOX10 does interact with the jasmonic acid biosynthesis pathway, and analysis of the nematode egg assay show that LOX7 and LOX8 do play a role in nematode resistance.

"Shape to Text to Shape"
Elii Nadeir*; Tracy Hammond