
# William Paterson University

## Biological and Chemical Sciences

300, POMPTON ROAD, WAYNE

NEW JERSEY-07470

April 22, 2017

# Program and Abstracts


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# "FEW WORDS FROM ORGANIZERS"

Few activities are as rewarding as research to the motivated students as well as faculty mentors. In addition to the acquisition of invaluable research skills, students learn how knowledge is created and experience the excitement of the "eureka moment". To celebrate undergraduate achievements, a research symposium has been held since 2007 on the WPUNJ campus for students in biological, chemical and environmental sciences. This symposium provides an opportunity to the students to showcase their talents and share their research achievements with their peers from about Thirty-Four universities from the Tri State area.

We would like to welcome all of you to an exciting 11th year of the Undergraduate Research Symposium at William Paterson University of New Jersey. This is an example of a budding community of undergraduate researchers. We want to thank all of the students from past and current who participated in the symposium and shared their research with us. We also want to thank all of the research mentors who have made it possible by investing their time, knowledge, resources and energy, so that undergraduates gain their first hand research experiences.

We express our gratitude to all of our student volunteers who show great enthusiasm and worked very hard to make this symposium a success.

We are very much obliged to Dr. Karen Schindler of the Cancer Institute of New Jersey, Rutgers University, for accepting our invitation as our keynote speaker and investing her valuable time to be with us.

This symposium could not have been successful without the moral support and continuous help from our Deans, Dr. Wolf and Dr. Fuller-Stanley, who worked very diligently with us so that everything is put together in a professional manner. Our

special thanks also due to Dr. Sandy DeYoung (Emeritus Dean), under whose direction and guidance this symposium was initiated.

We also want to thank Dr. David Slaymaker and Dr. Bhanu P. S. Chauhan (Chairs of the Biology and the Chemistry Departments) for their continued support. As well as the office of Institutional Advancement and the Alumni Association for partly financing the event in various capacities.

The symposium of this magnitude could not have been possible without the support we get from Dr. Warren Sandmann, Provost & Vice President of Academic Affairs.

Finally yet importantly, we extend our gratitude to President Kathleen Waldron for her leadership who continuously encouraged us and inspired us with her ideas to make this symposium a great success.

ORGANIZERS:
Dr. Jaishri Menon
Dr. Bhanu P. S. Chauhan

# Plenary Abstract 1

## "So You Got The Job… Now What?"

**Dr. Osama M. Musa**
**Vice President and Chief Technology Officer**
**Ashland, Inc.**

**In this talk, Dr. Musa will cover the following items.**

- **Overview of Ashland Inc. and Ashland's value differentiators**
- **Provide a specialty chemicals company's perspective regarding the steps required to be addressed to generate sustained innovation in Ashland's business.**
- **The right picture of success**
- **Obtaining success after getting a job**

## About Vice President Dr. Musa

Dr. Osama M. Musa is currently Vice President and Chief Technology Officer for Ashland Inc. (NYSE: ASH). He leads Ashland's Global Research and Development focusing on consumer and industrial markets including pharmaceutical, personal care, beverage, nutrition, agricultural, coatings, adhesives, and energy applications. Dr. Musa has overall responsibility for the global technology platforms including Molecular Science, Measurement Science, Process Research, Biofunctionals, Acrylates & Microencapsulation, Preservatives & Microbial Technology, as well as the R&D Stage-Gate development

process. He also leads the R&D Council and Multifunctional Innovation Engagement Team which are charged with managing and enhancing new product development processes. In addition to these technical roles, he has the commercial and technical responsibility for Ashland's Advanced Materials business.

Dr. Musa is a strategic R&D leader with broad experience in the specialty chemicals business sector. He utilizes a wide-ranging network, cooperating with partners both in the industry and in academia. Dr. Musa joined Ashland in 2011 following the company's acquisition of International Specialty Products (ISP) Incorporated. Previously, he held technical and leadership positions with the National Starch and Chemical Company.

As a passionate leader, Dr. Musa is committed to addressing customer needs through the application of innovative chemistry. He holds more than 50 issued U.S. patents and has authored numerous technical publications. From Ashland's Open Innovation platform, he cultivates student scholarship through numerous collaborations with universities, providing encouragement and motivational mentoring to the next generation of young, promising scientists. He serves as a member of the Board of Advisors at Manhattan College's Department of Electrical and Computer Engineering.

Dr. Musa earned a Ph.D. in organic chemistry from Wayne State University, where he also completed a post-doctoral fellowship. In addition, he received an M.S. in macromolecular chemistry from the University of Detroit Mercy, an M.S. degree in heterocyclic organic chemistry from the University of Jordan, and a B.S. in chemistry from Yarmouk University.

# Plenary Abstract 2

## "A Good Egg Is Hard To Find"

**Professor Karen Schindler**
**Department of Genetics, Rutgers University**
**145 Bevier Road, Piscataway, NJ**

Infertility affects 1 out of 6 couples in the U.S, often resulting from aneuploidy, a genetic abnormality in which a cell contains an improper number of chromosomes. The incidence of aneuploidy increases with maternal age; however, there is enormous variation in the frequency at any given age. This observation led to the hypothesis that additional genetic factors affect aneuploidy rate. Today I will speak to you about my on-going efforts to understand if there is a genetic link to maternal gamete aneuploidy risk. The long-term goal is to identify maternal genetic markers for risk of producing an aneuploid conception. I envision that this can help to prevent infertility by empowering women with necessary and personalized information to better preserve their individual fertility. Women's reproductive health and genetics is vastly understudied area of biomedical science, yet it is essential to our existence. This is what I will be marching for today, on this historic day for supporting science.

# About Professor Schindler

Karen Schindler, Ph.D. is an Assistant Professor of Genetics at Rutgers University. She is a member of the Human Genetics Institute of NJ and of the Rutgers University Cancer Institute of NJ Genome Instability and Cancer Genetics Program. Dr. Schindler received a B.S. in Biology from Loyola University in Maryland, and a Ph.D. in Biochemistry and Molecular Biology from Thomas Jefferson University. Her thesis work, under the guidance of Dr. Edward Winter, was focused on roles of meiosis-specific protein kinases in budding yeast. She then completed a postdoctoral fellowship with Dr. Richard Schultz at the University of Pennsylvania, where she began applying her research to important questions in reproductive biology – looking at how meiosis is regulated in females to make healthy eggs. Two competitive NIH fellowships, an F32 and a K99/R00 award, supported her work at Penn. In 2012, She began her research program at Rutgers, focusing on understanding the molecular mechanisms that cause aneuploidy in the female germline. The Schindler lab has made important contributions to the field by dissecting the functions of the Aurora protein kinases in mouse-oocyte meiosis, and it is pioneering the use of mouse oocytes as a bioassay for assessing the meiotic functions of human gene variants associated with infertility. Her work is supported by grants from the NIH, the American Society for Reproductive Medicine, and the Busch Biomedical Fund.


## *SYMPOSIUM ORGANIZING COMMITTEE*

### ***ORGANIZERS***

**Dr. Jaishri Menon**

**Dr. Bhanu P. S. Chauhan**

### ***Committee Members***

**Dr. Jean Fuller-Stanley**

**Dr. Michael Peek**

**Dr. Eileen Gardner**

**Dr. Jeung Woon Lee**

**Dr. Carey Waldburger**

**Dr. Pradeep Patnaik**

**Dr. Yalan Xing**

**Dr. Parminder Kaur**

**Dr. Jay Foley**

**Dr. Mihaela Jitianu**

**Dr. Emily Monroe**

**Dr. Mukesh Sahni**

**Ms. Karyn Lapadura**

# SCHEDULE OF EVENTS

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| **7:30 a.m. – 8:30 a.m.** | **Registration, Breakfast & Poster Setup**<br>**University Commons 171 A/B** |
| **8:30 a.m. – 8:45 a.m.** | Welcome and Opening Remarks, Ballroom<br>Dr. Warren Sandmann<br>Provost & Sr. VP for Academic Affairs |
| **8:45 a.m. – 10:45 a.m.** | POSTER SESSION A, Ballroom<br>Ecology, Evolution & Environmental Science: EEB1 – EEB11<br>Cell, Molecular Biology & Genetics I: CMBG1 – CMBG 9<br>Environmental Science: ES1 – ES12<br>Biochemistry: BC1 – BC11<br>Nanochemistry: NC1 – NC 8<br>Organic Chemistry: OC1 – OC9 |
| **11:00 a.m. – 11:45 a.m.** | PLENARY TALK 1, Ballroom<br>Dr. Osama M. Musa<br>VP & Chief Technology Officer, Ashland, Inc.<br>"So You Got The Job…Now What?" |
| **11:45 a.m. – 1:15 p.m.** | LUNCH - Wayne Dining Hall ; Science Hall TOUR |
| **1:15 p.m. – 3:15 p.m.** | POSTER SESSION B, Ballroom<br>Cell, Molecular Biology & Genetics II: CMBG10 – CMBG17<br>Physiology & Toxicology: P&T1 – P&T9<br>Biological Sciences: BS 1 – BS 6<br>Computational & Physical Chemistry: C&P1 – C&P7<br>Materials Chemistry: MC1 – MC8 |
| **3:30 p.m. – 4:30 p.m.** | PLENARY TALK 2, Ballroom<br>Dr. Karen Schindler |

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| | Department of Genetics, Rutgers University<br>"A Good Egg Is Hard To Find" |
| **4:3 0 p.m. – 5:00 p.m.** | Alumni Panel, Ballroom |
| **5:00 p.m.** | AWARDS CEREMONY, Ballroom |

## Poster Session: Ecology, Evolution & Behavior

JUDGES: Dr. James Arnone*
Dr. Michael Sebetich
Dr. James Salierno
Dr. Thomas Owen

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| **EEB 1** | **RESTING STATE FMR1 AND EXPOSURE TO VIOLENCE DURING CHILDHOOD**; ***Nadine Aboukaff*** and Dr. Samantha Smolin; Department of Psychology, Rutgers University, Newark, NJ | |
| **EEB 2** | **DO ENVIRONMENT AND DEVELOPMENT AFFECT COCKROACH AGGREGATION?** ***Linda Ali*** and Dr. Scott Kight, Department of Biology & Molecular Biology, Montclair State University, Montclair, NJ | |
| **EEB 3** | **COMPETITIVE BODYBUILDERS ARE AT RISK FOR DEVELOPING BINGE EATING DISORDER; *Kelly Davison[1]***<br>Dr. Julie Fagan[2], [1]Department of Nutritional Sciences, [2]Department of Animal Sciences, Rutgers University, New Brunswick, NJ | |
| **EEB 4** | **WHY IS RECYCLING IMPORTANT?** ***Ashley DeMaria*** and Dr. Antonia Florio, Department of Biology, St. Francis College, Brooklyn, NY | |
| **EEB 5** | **THE EFFECT OF MIRROR THERAPY ON REHAB PATIENTS;** ***Maria Duardo*** and Dr. Gaby Fahmy, Department of Natural Sciences, Felician University, Lodi, NJ | |
| **EEB 6** | **COMPARISON OF INDIVIDUAL BEHAVIOR AND SOCIAL DYNAMICS BETWEEN CAPTIVE PENGUIN SPECIES AT ZOOLOGICAL PARKS ANDF AQUARIUMS;** ***Marisa Grisaffi*** and Dr. Brian Olechnowski, Department of Biological & Allied Health Sciences, Fairleigh Dickinson University, Madison, NJ | |
| **EEB 7** | **HORMONAL AND NEUROANATOMICAL CHANGES ASSOCIATED WITH RODENT PAIN BEHAVIORS;** ***Danielle Hagee & Katherine LoMauro***, and Dr. J.W. Lee, Department of Biology, William Paterson University, Wayne, NJ | |
| **EEB 8** | **THE BIOLOGY OF DESIRE: NEUROTRANSMITTER** | |

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| | **MEDIATED BEHAVIOR IN CHERRY SHRIMP (*NEOCARIDINA DAVIDI*); *Molly Mancuso, Carla Granada***, Kayla Adams, and Dr. Joseph Stout, School of Natural Sciences, Fairleigh Dickinson University, Teaneck, NJ | |
| **EEB 9** | **KCNQ $K^+$ CHANNELS AS A PHARMACEUTICAL TARGET FOLLOWING A TRAUMATIC BRAIN INJURY; *Nicholas Scibetta*** and Dr. Sonya Bierbower, Department of Biology, William Paterson University, Wayne, NJ | |
| **EEB 10** | **ASSOCIATION OF DEMOGRAPHIC AND ENVIRONMENTAL FACTORS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER IN THE UNITED STATES; *Michael Sun*[3]** and Dr. Kevin Sun[1&2], [3]Department of Geological, Environmental & Marine Sciences, Rider University, Lawrenceville, NJ [3]Department of Biology, Johns Hopkins University, Baltimore, MD; [2]Pennsbenury High School, Levittown, PA | |
| **EEB 11** | **CELLULAR DAMAGE INVESTIGATIONSD FDUE TO VARYING SEVERITY OF TRAUMATIC BRAIN INJURY; *Maria Zamora*** and Dr. Sonya Bierbower, Department of Biology, William Paterson University, Wayne, NJ | |

***Coordinator**

## Poster Session: Cell, Molecular Biology & Genetics

**JUDGES: Dr. Carey Waldburger***
**Dr. Alice Benzecry**
**Dr. Alfred Castro**
**Dr. Yiingcui Li**

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| **CMBG 1** | **INDUCING RNAI IN *C. ELEGANS* BY USING E. *COLI* TO DISRUPT THE *UNC-22* GENE AND DISTINGUISH THE GENE'S CORRESPONDING MUTANT PHENOTYPE; *Amanda Almeida*** and Dr. Rongsun Pu, Biology Department, Kean University, Union, NJ | |
| **CMBG 2** | **USING *C. ELEGANS* AS A MODEL SYSTEM TO IDENTIFY GENES THAT FUNCTION DURING THE PROCESS OF CELL MIGRATION; *Bernieve Dabdy, John Carlet*** and Dr. Andre Wallace, School of Natural Sciences, Fairleigh Dickinson University, Teaneck, NJ | |
| **CMBG 3** | **MITOCHONDRIAL INHERITANCE IN *SACCHAROMYCES CEREVISIAE* SEPTIN** | |

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| | **MUTANTS; *Sonia Giyanani, Sophia Porras,*** and Dr. Patricia Melloy, Biological & Allied Health Scciences, Fairleigh Dickinson University, Madison, NJ | |
| **CMBG 4** | **ESTABLISHMENT OF OPTIMAL MC3T3 OSTEOBLASTID DIFFERENTIATION CONDITIONS; *Nick Luke*** and Dr. Thomas Owen, TAS Research Honors, Ramapo College of NJ, Mahwah, NJ | |
| **CMBG 5** | **USE OF CRISPR/CAS-9 GENOME EDITING TO GENERATE POINT MUTATIONS IN THE RAT SIT GENE; *Jeferson Mendoza*** and Dr. Thomas Owen, Biology Department, Ramapo College of NJ, Mahwah, NJ | |
| **CMBG 6** | **ANAYSIS OF P53 FUNCTION IN NEUROBLASTOMA CELL LINES; *Rebecca Pappalardo*** and Dr. Aime Levesque, Department of Biology, University of Hartford, West Hartford, CT | |
| **CMBG 7** | **POST-TRANSCRIPTIONAL PROCESSING OF THE MITOCHONDRIAL ATP8 GENE: A POTENTIAL CAUSE FOR S-TYPE CYTOPLASMIC MALE STERILITY IN MAIZE; *Avisek Parajuli*** and Dr. Terry Kamps, Biology Department, New Jersey City University, Jersey City, NJ | |
| **CMBG 8** | **DETERMING THE EFFECTS OF A WESTERN DIET ON THE DISTRIBUTION OF MICROGLIA WITHIN CEREBELLAR CORTEX OF NPC1 MUTANT MICE; *Constantine Pella*** and Dr. Ilena Soto-Reyes, Department of Biology, Rowan Univesity, Glassboro, NJ | |
| **CMBG 9** | **AN INVESTIGATION OF SPATIAL POSITIONING AND THE CONSERVATION OF ADJACENT CO-REGULATION WITHIN TOXIC RESPONSE GENES IN *SACCHAROMYCES CEREVISIAE; Exequiel Sisso*** and Dr. James Arnone, Department of Biology, William Paterson University, Wayne, NJ | |

***Coordinator**

## Poster Session: Environmental Science

**JUDGES: Dr. Karen Swanson***
**Dr. Antoia Florio**

## Dr. Sara Reynolds

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| ES 1 | **BENTONITE EFFECTS ON MICROBIAL COMPOSITION; *Kayla Adams, Lytane Boyer,* Brian Hochstuhl,** and Dr. Alice Benzecry, School of Natural Sciences, Fairleigh Dickinson University, Teaneck, NJ | |
| ES 2 | **PREHISTORIC HUMAN CUTUAL SHIFTS IN THE MID-ATLANTIC: EVIDENCE OF CLIMATE INFLUENCE ON ARCHAIC CULTURES IN NEW JERSEY INFRERRD FROM A 15,000-YEAR LAKE SEDIMENT CORE; *Chris Brown*[1], Kyle Hansen[1], Seth Getch[1], David Gillikin[2], Stefanie Brachfeld[3], Mike DaSilva[1], Dr. Michael Grifiths[1], Dr. Richard Pardi[1] and Dr. Michael Sebetich[1], [1]Department of Environmental Science, William Paterson University, Wayne, NJ, [2]Department of Geology, Union College, Schenectady, NY, [3]Earth & Environment Sciences, Montclair State University, Montclair, NJ** | |
| ES 3 | **DETRIMENTAL IMPACT OF COMBINED SEWER OVERFLOWS ON WATER QUALITY AT SELECTED LOWER HUDSON RARITAN ESTUARY SITES; *Carol Ellameh,* Merna Bishai, Jessica Acosta,** Dr. Allison Fitzgerald, and Dr. Meriem Bendoud, Department of Biology New Jersey City University, Jersey City, NJ | |
| **ES 4** | **GENERATING NEW ULTRA-SENSITIVE TEMPERATURE RECONSTRUCTION IN MONGOLIA USING BUE INENSITY REFLECTANCE; *Jessica Geary,* Rose Oelkers, Christian Reyes,** and Dr. Nicole Davi, Department of Environmental Science, William Paterson University, Wayne, NJ | |
| **ES 5** | RECONSTRUCTING SURFICIAL GEOLOGY IN THE NORTHERN NEW JERSEY PIEDMONT UTILIZING FOSSILIFEROUS GLACIAL ERRATICS FROM THE LOWER AND MIDDLE DEVONIAN OF EASTERN NEW YORK; ***Christopher Gocklin*[1], *Richard Plattel*[1], *Harry Maisch IV*[2], *Michael Dubaldi*[3],** Dr. Martin Becker[1], Dr. John Chamberlain[2], Dr. Alexander Bartholomew[3], and Dr. Rebecca Chambelain[4], [1]Department of Environmental Science, William Paterson University, Wayne, NJ, [2]Earth & Environmental Science, CUNY, New York, NY, [3]Geology Department, The | |

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| | State University of New York At New Paltz, New Paltz, NY, [4]Department of Biology, College of Staten Island, Staten Island, NY | |
| **ES 6** | **HYDROGEL APPLICATION AS A SAMPLING TOOL FOR BACTERIAL CELLS; *Tianna Grant[1]*** and Dr. Vipin Rastogi[2], 1Department of Biology & Health Sciences, St. Francis College, Brooklyn, NY, [2]U.S. Army Edgewood Chemical Biological Center, Edgewood, MD | |
| **ES 7** | **SEASONAL VARIATION IN INNATE IMMUITY IN THE RUBBER BOA (*CHARINA BOTTAE); *Ayham Khrain*** and Dr. Joseph Agugliaro, Biological & Allied Health Sciences, Fairleigh Dickinson University, Madison, NJ | |
| **ES 8** | **SEALS AND THE CITY: PINNIPEDS ARE RETURNING TO URBAN WATERWAYS; *Kelly Michalak[1,3], Dareen Generoso[1,3],* Afia Azaah[1,3],** Dr. Kevin Woo[2,3], and Dr. Kristy Biolsi[1,3], [1]Psychology Department, St. Francis College, Brooklyn Heights, NY, [2]Division of Science, Mathematics & Technology, SUNY Empire State College, New York, NY, [3]Center for the Stury of Pinniped Ecology & Cognition, St. Francis College, Brooklyn Heights, NY | |
| **ES 9** | **HABITUATED AND LEARNED RESPONSES TO ENVIRONMENTAL STIMULI IN BIRDS AND RELATIONSHIP TO OPTIMAL FORAGING THEORY; *Alexandra Mueller,*** and Dr. Brian Olechnowski, Department of Biological & Allied Health Sciences, Fairleigh Dickinson University, Madison, NJ | |
| **ES 10** | **MACROPHYTE DIVERSITY AND WATER QUALITY IN SIX FINGER LAKES; *Lyla O'Brien,*** and Dr. Bin Zhu, Department of Biology, University of Hartford, Hartford, CT | |
| **ES 11** | **THE INHIBITING EFFECT OF ESSENTIAL OILS AND METHYLGLYOXAL WITH CASRRIER OILS ON THE GROWTH OF *PSEDUDOMONAS AERUGINOSA; Aashna Patel*** and Dr. James Mack, Biology Department, Monmouth University, West Long Branch, NJ | |
| **ES 12** | **CHEMICAL COMPARISON OF MODERN AND FOSSIL SHARK (LAMNIFORM) TEETH; *Fatima Popcakova[+], Aiah Pilapil[^],* Richard Plattel[+], Chrisopher Glocklin[+], Mohamed Eita[^], Qiaxian Johnson[+]**, Dr. Michael Griffiths[+], Dr. Martin Becker[+] and Dr. Bhanu Chauhan[*+], [+]Department of Chemistry, William Paterson University, Wayne, NJ, [+]Department of Environmental Science, William | |

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| | Paterson University, Wayne, NJ | |

***Coordinator**

## Poster Session: Biochemistry

**JUDGES: Dr. Parminder Kaur***
**Dr. Moni Chauhan**
**Dr. Elena Galoppini**
**Dr. Sujun Wei**

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| **BC 1** | **PHOSPHOPROTEIN ENRCHED IN ASTROCYTES 15 (PEA-15) CHANGES CONFIRMATION UPON PHOSPHORYLATION & INTERATION WITH FADD; *Sergio Crespo*, Julissa Marrero, Victor Leon**, and Dr. Yufeng Wei, Chemistry Department, New Jersey City University, Jersey City, NJ | |
| BC 2 | **EFFECTS OF HAWAIIAN PLANT EXTRACTS ON METASTATIC PROSTATE CANCER CELLS; *Tamara Gillot[1], Anna Galuza[1]* Fayloa Levine[1], Leng Chee Chang[3]**, and Dr. Olorunseun Ogunwobi[1,2], [1]Department of Biological Sciences, Hunter College, CUNY, [2]The Graduate Center of Biology & Biochemistry, CUNY, NY, NY, [3]Departments of Pharmaceutical Sciences, University of Hawaii Hilo, HI | |
| BC 3 | **BENTONITE EFFECTS ON LECTIN-LIKE SUBSTANCES IN THE HACKENSACK RIVER; *Mercy Ho,* Angelica Guzman, Johnnuy Estrella,** Dr. Alice Benzecry, and Dr. Harvey Winters, School of Natural Sciences, Fairleigh Dickinson University, Teaneck, NJ | |
| BC 4 | **SYNTHETIC STUDY & BIO-ACTIVITY TESTING OF ACTINOPOLYMORPHOL B; *Jolanta Jedryczka***, and Dr. Yalan Xing, Department of Chemistry, William Paterson University, Wayne, NJ | |
| BC 5 | **SYNTHETIC AND BIOCHEMICAL EXPLORATIONS OF THE TIANEPTINE SCAFFOLD; *Elizaveta Kulko*, A. Kruegel, M. Gassaway, A. Petrovic**, and Dr. Dalibor Sames, Chemistry Department, Columbia University, New York, NY | |
| BC 6 | **EFFECTS OF NOVEL COMPOUNDS EXTRACTED FROM HAWAIIAN PLANTS ON PANCREATIC CANCER; *Fayola Levine[1]***, and Dr. Olorunseun Ogunwobi[1,2], [1]Department of Biological Sciences, Hunter College, CUNY, [2]The Graduate Center of | |

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| | Biology & Biochemistry, CUNY, NY, NY, [3]Departments of Pharmaceutical Sciences, University of Hawaii Hilo, HI | |
| BC 7 | **PROTEIN PURIFICATION WITH USE OF SINGLE GST COLUMN; *Amy Ng***, and Dr. Yong-Ick Kim, Department of Chemistry, New Jersey Institute of Technology, Newark, NJ | |
| BC 8 | **BIOCHEMICAL STUDIE4S OF BACTERIAL GROWTH AND PROTEIN EXPRESSION PATTERNS OF GUT MICROBES INCLUJDING LACTOBACILLUS RHAMNOSUS GG AND ESCHERICHIA COLI K-12 USING UV-VIS SPECTROPHOTOMETRY, TWO DIMENSIONAL GEL ELECTROPHORESIS AND FAXT PERFORMANCE LIQUID CHROMATOGRAPHY; *Devashri Parikh, Pritha Aggarwal, Kaci Kopec*, Nicole Rodstrom, Claudia Borodziuk**, and Dr. Seung-Sup Kim, Biochemistry Department, Ramapo College of New Jersey, Mahwah, NJ | |
| BC 9 | **HORSE LIVER ALCOHOL DEHYDROGENASE EXPRESSION IN E. COLI; *Amara Qureshi***, Dr. Peter Kahn, and Dr. Natalya Voloshchuk, Department of Biochemistry & Microbiology, Rutgers University, New Brunswick, NJ | |
| BC 10 | **DIAMINE OXIDASE ENHANCES BY A GREEN PROCEDURE; *Kevin Ramirez* Uday Kiran Biija, Dinesh-Amraram Choudhary**, Dr. Michaela Leonida, and Dr. Ish Kumar, School of Natural Sciences, Fairleigh Dickinson University, Teaneck, NJ | |
| BC 11 | **CIRCADIAN CLOCK IN CYANBACTERIA; *Aesha Shah,*** and Dr. Yong-Ick Kim, Department of Chemistry, New Jersey Institute of Technology, Newark, NJ | |

***Coordinator**

## Poster Session: Nanochemistry

**JUDGES: Dr. Yalan Xing***
**Dr. David Moore**
**Dr. Chohan Balwant**
**Dr. Yufeng Wei**

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| NC 1 | **SYNTHESIS OF POLYSTYRENE COATED WSITH GOLD NANOPARTICLES FOR THE APPLICATIONS OF PLASTICS; *Natasha Ampomah,* Kelly Moran, Qiaxian Johnson**, and Dr. Bhanu Chauhan, Department of Chemistry, William Paterson University, Wayne, NJ | |
| NC 2 | **HISTAMINASE DELIVERED BY NANOPARTICLUATE CHITOSANS; *Dinesh-Amraram Choudhary, Faith Adams***, and Dr. Mihaela Leonida, School of Natural Sciences, Fairleigh Dickinson University, Teaneck, NJ | |
| NC 3 | **CONVENTIONAL FMOC SOLID-PHASE SYNTHESIS, BIOCONJUGATION AND CHARACTERIZATION OF CANDER-TARGETING PEPTIDES; *Adah Beckj, Andrei Darwich, Claudia Heller,* Niki Rana, Mariana Phillips, Christopher Cultrara,** and Dr. David Sabatino, Department of Chemistry & Biochemistry, Seton Hall University, South Orange, NJ | |
| NC 4 | **SILVER MEDIATED POLYRHODANINE POLYSILOXANE NANOCOMPOSITES; *Evens Esperance[1], Anjali Gaba[1]*, Tao Hong[1], Aarti Patel[2],** Dr. Moni Chauhan[1], and Dr. Bhanu Chauhan[2], [1]Department of Chemistry, Queensborough Community College, CUNY, New York, NY, [2]Department of Chemistry, William Paterson University, Wayne, NJ | |
| NC 5 | **SYNTHESIS OF CO_GELS OF POLYMETHYLHYDROSIOXANE AND POLYBUTADIENES AND THEIR THETHERING WITH ORGANIC FUNCTIONALITIES; *Ralph Fleurant-Jean,* Daniela Artiga, Qiaxian Johnson,** and Dr. Bhanu Chauhan, Department of Chemistry, William Paterson University, Wayne, NJ | |
| NC 6 | **MOLECULAR IMPRINTED POLYMERS FROM ACETYLATED PEI; *James Mizvesky, Arielle Golod,*** and Dr. Mohammed Elshaer, Department of Chemistry & Pharmaceutical Science, Fairleigh Dickinson University, Madison, NJ | |
| NC 7 | **GOLD NANOPARTICLES MEDIATED RUPTURE OF POLYMERSOMES USING ULTRAFAST SINGLE PULSE IRRADIAITON; *Abby Robinson***, and Dr. Julianne Griepenburg, Department of Chemistry, Rutgers, University, Camden, NJ | |
| NC 8 | **IIMPACT OF MOLECULAR LENGTH AT OLIGOCARBAZOLE SINGLE MOLECULE WIRES; *Patrick Tuttle[1],* Cole Sagan[2], Jiayi Xue[1],** | |

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| | **Xiaofang Megan Yu[1], Gina Florio[2],** and Dr. Sujun Wei[1], [1]Deparment of Chemistry, Queensborough Community college, Bayside, NY, [2]Department of Chemistry & Physics, St. John's University, Queens, NY | |

***Coordinator**

## Poster Session: Organic Chemistry

**JUDGES: Dr. Jay Foley***
**Dr. Andrei Jitiani**
**Dr. Hemray-Benny Tirandai**
**Dr. Ish Kumar**

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| OC 1 | **SYNTHESIS OF A, A, -DIBROMOKETONE CXATALYZED BY ORGANOSILANES FROM ALKYNES; *Carlos Chong, Justin Donmena***, Dr. Yalan Xing and Dr. Bhanu Chauhan, Department of Chemistry, William Paterson University,Wayne, NJ | |
| OC 2 | **SYNTHESIS, PURIFICATION AND CHARACTERIZATION OF ASYMMETRIC FLUORINATED PHTHALOCYANINES; *Ralph Foglia III,* O. Xiao, M. Pelmus,** and Dr. Sergiu Gorun, Department of Chemistry & Biochemisry, Seton Hall University, South Orange, NJ | |
| OC 3 | **RADICAL OXIDATIVE COUPLING REACTION OF ALCOHOLS AND ALKYNES; *John Lee*** & Dr. Yalan Xing, Department of Chemistry, William Paterson University, Wayne, NJ | |
| OC 4 | **MANGANESE-PROLINE DERIVED NEW CATALYST SYSTEM FOR THE ENANTIOSELECTIVE SYNTHESIS OF α-HYDROXY PHOSPHONATES/α-AMINO PHOSPHONATES; *Hyun Lim, Prianka Chohan,Muttalik Khan,* Vicklyn Datilus, Rania Teriak**,a nd Dr. Parminder Kaur, Department of Chemistry, William Paterson University, Wayne, NJ | |
| OC 5 | **SEQUENTIAL EXPERIMENTS TO SYNTHESIZE DIPHENYLACETYLENE FROM STYRENE IN THE UNDERGRADUATE LABORATORY; *Matthew*** | |

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| | ***McCloskey, Thanuka Udumulla***, and Dr. Sarah Carberry, Department of Chemistry, Ramapo College of New Jersey, Mahwah, NJ | |
| OC 6 | **A NOVEL NITROGEN-NIGTROGEN BOND FOMATION: SYNTHESIS OF [2H]-INDAZOLES; *Thomas Puleo*** and Dr. Edward Salaski, Department of Chemistry & Pharmaceutical Science, Fairleigh Dickinson University, Madison, NJ | |
| OC 7 | **TITANUIUM-PROLINE DERIVED SYSTEM FOR THE ASYMMETRIC SYNTHESIS OF PROPARGYL ALCOHOLS; *Chelsea Sweet,* Dina Moustafa, Laura Perdomo-Quintero,** and Dr. Parminder Kaur, Department of Chemistry, William Paterson University, Wayne, NJ | |
| OC 8 | **CARBOXYLIC ACID FUNCTIONALIZED CATIONIC PORPHYRINS; *Rebecca Wodzinski,* Isma'il Kadam, Jesse Hackett,** and Dr. Mohammed Elshaer, Department of Chemistry & Pharmaceutical Science, Fairleigh Dickinson University, Madison, NJ | |
| OC 9 | **SYNTHESIS OF HETEROCYCLIC INDOLIZINES AND ITS APPLICATION IN ANTIBACTERIAL ACTIVITY STUDIES; *Ming Zhang***, Dr. Yalan Xing and Dr. Martin Kendall, Department of Chemistry and Department of Biology, William Paterson University, Wayne, NJ | |

***Coordinator**

## Poster Session: Cell, Molecular Biology & Genetics II

**JUDGES: Dr. Pradeep Patnaik***
**Dr. David Slaymaker**
**Dr. Brian Olechnowski**
**Dr. Kathleen Nolan**

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| CMBG 11 | **DETERMINATION OF THE EBOLA VIRUS 5-UTR SECONDARY STRUCTURE; *Stephan Andersen***, and Dr. Jonathan Ouellet, Department of Chemistry & Physics, Monmouth University, Hillsborough, NJ | |

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| CMBG 12 | **SYSTEMATIC CHARACTERIZATION OF THE REGULATORY ROLE OF ADJACENT GENE CO-REGULATION IN THE BUDDING YEAST RIBOSOMAL PROTEIN REGULON; *Reem Eldabagh***, and Dr. James Arnone, Biology Department, William Paterson University, Wayne, NJ | |
| CMBG 13 | **INVESTIGATING INTO THE ROLE OF SPATIAL POSITIONING AND ADJACENT GENE CO-REGULATION IN THE COORDINATION OF THE HEAT SHOCK PROTEINS GENE EXPRESSION IN, *SACCHARMOYCER CEREVISIAE;Maria Holganza***, and Dr. James Arnone, Biology Department, William Paterson University, Wayne, NJ | |
| CMBG 14 | **EXAMINING THE ROLE OF FASCIN IN PRIMARY BRAIN** CANCERS; ***Syed Mehdi Husaini, Faraz Jamal*****,** and Dr. Cathryn Kubera Department of Biology**,** Monmouth University, Long Branch, NJ | |
| CMBG 15 | **THE CELL TYPE SPECIFIC EFFECTS OF RNA BINDING PROTEIN HUD ON NEOCORTICAL PROJECTION NEURON IDENTITY; *Nicholas Page*** and Dr. Mladen-Roko Rasin,Department of Cell Biology and Neuroscience, Rutgers University, Piscataway, NJ | |
| CMBG 16 | **A NOVEL STUDY OF THE AGCCRE "KNOCKOUT" TRANSGENIC MOUSE MODEL; *Kyle Vaccaro, Kemar Edwards***, and Dr. Yingcui Li, Department of Biology, University of Hartford, West Hartford, CT | |
| CMBG 17 | **CLONING OF A FLUORESCENT REPORTER GENE AS AN ASSAY FOR RIBOSWITCH MODULATION; *Toni Zangrilli*** and Dr. Ouellet, Department of Chemistry and Physics, Monmouth University, West Long Branch, NJ | |

***Coordinator**

## Poster Session: Physiology & Toxicology

**JUDGES: Dr. Robert Benno***
**Dr. Terry Kamps**
**Dr. Mengtyan Li**

**Dr. Natalya Voloshochuk**

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| **P & T 2** | **THE EFFECT OF DETERGENT ON THE INHIBITYION OF MATRIX METALLO PROTGEINASE (MMP) 1; *Rinat Khundoker, Bora Donmer*, Iwon Sato**, and Dr. Ish Kumar, School of Natural Sciences, Fairleigh Dickinson University, Teaneck, NJ | |
| P & T 3 | **TOLERANCE LIMITS OF CELLS TO NICOTINE EXPOSURE; *Antonio Leontaris***, and Dr. Robert Rogers, Department of Biology, Felician University, Rutherford, NJ | |
| P & T 4 | **SEASONAL VARIATION IN ACTIVITY METABOLISM OF THE RUBBER BOA (*CHARINA BOTTAE*); *Christine Macri*** and Dr. Joseph Agugliaro, Department of Biological & Allied Health Sciences, Fairleigh Dickinson University, Florham Campus, Madison, NJ | |
| P & T 5 | **REGULATION OF CAMKII AT INHIBITORY SYNAPSES BY CALDINEURIN, *Michael Malkowski, Roxanne Aguilera***, and Dr. Reed Carroll Department of Biology, New Jersey City University, Union City, NJ | |
| **P & T 6** | **LIFE AND DEATH PARTNERS: OXIDATIVE STRESS AND AUTOPHAGY DURING SKIN MORPHOGENESIS IN TADPOLES *XENOPUS LAEVIS; Sirai Ramirez*** and Dr. Jaishri Menon. Department of Biology, William Paterson University, Wayne, NJ | |
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| P & T 8 | **QUANTITATIVE COMPARISON OF NUCLEAR AND SOMATIC CAMKIV EXPRESSION IN PYRAMIDAL VISUAL CORTEX NEURONS; *Victor Suarez***, and Dr. Gina Turrigiano, New Jersey Center for Science, Technology & Mathematics, Kean University, Union, NJ | |
| P & T 8 | **ROAD SALT EXPOSURE ALTERS SURVIVAL, PHYSIOLOGY, AND REPRODUCTION IN *DAPHNIA MAGNA; Brittani Willaims-Fell*** and Dr. James Salierno | |

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| | Department of Biological and Allied Health Sciences<br>Fairleigh Dickinson University, Madison, NJ | |

***Coordinator**

## Poster Session: Biological Sciences

**JUDGES: Dr. Sonya Bierbower***
**Dr. Mohammed Elshaer**
**Dr. Reginald Halaby**

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| BS 2 | **"EGG-CITING" ORGAN RUDIMENT CULTURE: CAM LAYER VS. VITELLINE MEMBRANE FOR THE GROWTH OF A CHICK'S BEAK; *Nikia Grant, Tiana Thurmond*, Samantha Makin, Lyla O'Brien, Shanae Robinson,** and Dr. Yingcui Li, Department of Biology, University of Hartford, West Hartford CT | |
| BS 3 | **BATTLE OF THE WATER FILTERS; *Mackenzie Myers*, Kelsey Mendoza, Jenna Ellington, Hana Khalifa, Ashara Mitchell**, and Dr. Kathleen A. Nolan Department of Biology and Health Sciences St. Francis College, Brooklyn, NY | |
| **BS 4** | **A QUEST TO DISCOVER AND IDENTIFY NEW ANTIBIOFILM BACTERIAL COMPOUNDS INHIBITING BIOFILM FORMATION OF PATHOGENIC BACTERIA; *Page Rossano,* Erick Gonzalez, Carol Ellameh, Destin Mikouiza-Mbassi**, and Dr. Meriem Bendaoud Department of Biology, New Jersey City University, Jersey City, NJ | |
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| **BS 6** | **EVALUATION OF GUANOFURACIN AS AN ANTIBIOTIC ; *Jennifer Trabucco*** and Dr. Thomas Owen, Biology Department, Ramapo College of New | |

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| | Jersey, Mahwah, NJ | |

***Coordinator**

## Poster Session: computational & Physical Chemistry

**JUDGES: Dr. Mihaela Jitianu***
**Dr. Parminder Kaur**
**Dr. Moni Chauhan**
**Dr. Mihaela Leonida**

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| CP 4 | **MODELING RESONANT ENERGY TRANSFER IN HYBRID NANOPARTICLES;** ***Matthew Micek*** and Dr. Jonathan Foley, Department of Chemistry William Paterson University, Wayne, NJ | |
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| | Department of Math & Natural Sciences, Centenary University, Hackettstown, NJ | |
| CP 7 | **SYNTHESIS AND CHARACTERIZATION OF TWO MEROCYANINE SOLVATOCHROMIC PROBES FOR USE IN AQUEOUS SYSTEMS; *Erin Whaley,*[1] Kate Selivanovich,[2*] Shaday Edwards,[1] Malliswari Ponnala,[2] , Shashikanth Ponnala[1]**, and Dr. Robin Helburn[1], [1]Dept of Chemistry & Physics, St. Francis College, Brooklyn Heights NY.\, [2]Dept of Chemistry, Indiana University, Bloomington IN. [3]Dept of Chemistry, CUNY-Hunter College, NY NY | |

***Coordinator**

## Poster Session: Material Chemistry

**JUDGES: Dr. Jay Foley***
**Dr. Yalan Xing**
**Dr. Sujun Wei**
**Dr. Kim Seung-Sup**

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| MC 2 | **THE STUDY OF TETRAMETHYLCYCLOSILOXANES ON SYNTHESIS AND SELF-ASSEMBLY OF SILVER NANOPARTICLES; *Daniela Artiga*, Glory Nkak, Saadia Chaudhry, Aarti Patel**, and Dr. Bhanu P. S. Chauhan, Department of Chemistry, William Paterson University, Wayne, NJ | |
| MC 3 | **THE IMPREGNATION OF NOBLE METAL NANOPARTICLES INTO STÖBER SILICA FOR POSSIBLE APPLICATIONS IN CATALYSIS; *Edwin Elias*, *Juan Leiva*, Qiaxian R. Johnson,** and Dr. Bhanu P.S. Chauhan, Department of Chemistry, | |

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| | William Paterson University, Wayne NJ | |
| MC 4 | **NANOSTRUCTURED $TiO_2$ - HYDROTALCITE COMPOSITES FOR VANILLIN PHOTOCATALYTIC DECOMPOSITION; *Anhay Hernandez-Mujica*[1], Naphtali O'Connor[2], Ravnit Kaur-Bhatia[2]**, Dr. Andrei Jitianu[2], and Dr. Mihaela Jitianu[1] [1]Department of Chemistry, William Paterson University, Wayne, NJ , [2]Department of Chemistry, Lehman College – City University of New York, West, Bronx, NY | |
| MC 5 | **A COMPARATIVE ANALYSIS OF VARIOUS METAL NANOCATALYSTS AND THEIR EFFICIENCY CONVERTING *p*-NITROPHENOL TO *p*-AMINOPHENOL; *Kelly Moran*, Aarti Patel, Qiaxian Johnson**, and Dr. Bhanu P.S. Chauhan, Department of Chemistry, William Paterson University, Wayne,NJ | |
| MC 6 | **PHENYL MODIFIED HYBRID GLASSES FOR ANTICORROSIVE APPLICATIONS; *Gabriela Rodriguez*[1], I. Levy[2], M. Aparicio[3], Rana Daher[4]**, Dr. Mihaela Jitianu[4], L.C. Klein[5],and Dr. Andrei Jitianu[1, 2] [1]Lehman College, City University of New York, Department of Chemistry, Davis Hall, Bronx, NY [2]PhD. Program in Chemistry and Biochemistry, The Graduate Center of the City University of New York, New York, NY,[3]Instituto de Cerámica y Vidrio, Consejo Superior de Investigaciones Científicas (CSIC), Kelsen 5 (Campus de Cantoblanco) 28049 Madrid, SPAIN, , [4] William Paterson University, Chemistry Department, Wayne, NJ, [5]Department of Materials Science and Engineering, Rutgers University, Piscataway, NJ | |
| MC 7 | **IONIC LIQUID MIXTURES WITH SINGLE-WALLED CARBON NANOTUBES AS ELECTROLYTES FOR DYE-SENSITIZED SOLAR CELLS; *Rawlric Sumner*, Sharon Lall-Ramnarine** *and* Dr. Tirandai Hemraj-Benny Department of Chemistry, Queensborough Community College, The City University of New York, Bayside, NY | |
| Mc 8 | **SYNTHESIS OF HETEROGENEOUS PHOTOCATALYSTS BY COVALENT BONDING OF PHTHALOCYANINES TO FUNCTIONALIZED SILICA; *Olivia Xiao*, Ralph Foglia III, Pelmus, M.**, and Dr. Sergiu Gorun, Department of Chemistry and Biochemistry, Seton Hall University, South Orange NJ | |

***Coordinator**

# POSTER ABSTRACTS

# RESTING STATE FMRI AND EXPOSURE TO VIOLENCE DURING CHILDHOOD

***Nadine Aboukaff*** and Dr. Samantha Smolin
Department of Psychology
Rutgers University, Newark, NJ

Environmental aspects during childhood may alter neural activity. For example, exposure to violence that children experience may cause neural differences in comparison to children who may not have had this same exposure. While research suggests that early life stress, such as deprivation of social and physical resources, results in differences in neural response to rewards and threats, no research to our knowledge has shown similar effects for exposure to violence, which is a common problem in urban neighborhoods. The goal of this research is to determine whether exposure to violence during childhood results in neural differences in resting state functional activity. Resting state looks at which neural regions are activated and connected in an individual while at rest. A between group analysis will be conducted between individuals exposed to high compared to low levels of violence, with the same amount of people in each group as well as a control between other factors including socioeconomic status. The functional neuroimaging (fMRI) data was collected while participants were in the scanner looking at a fixation cross for seven minutes. This resting state activity will be analyzed specifically in terms of functional connectivity from the ventromedial prefrontal cortex (vmPFC) seed region. The vmPFC is a region implicated in reward processing and is typically shown to be connected to subcortical neural regions, such as the caudate, putamen, and amygdala. It is hypothesized that individuals with exposure to high levels of violence during their childhood years will present decreased levels of connectivity between the vmPFC and subcortical regions implicated in reward and threat processing, such as the, caudate, putamen, and amygdala, in comparison to individuals with exposure to low levels of violence. During childhood, exposure to violence can cause high levels of exposure to threat and stress. Exposure to high levels of early life stress has been shown to result in increased neural responsivity to threatening stimuli, as well as decreases in emotional regulation. The vmPFC has been shown to regulate subcortical regions, and thus we expect decreased connectivity from vmPFC to subcortical neural regions for individuals exposed to high levels of violence during childhood. As violence continues to be a prevalent problem in society, it is of importance to learn of the possible effects this may have on neural activity. Depending on our understanding of the neural effects of this environmental stressor may also serve to enhance our ability to provide helpful interventions.

## DO ENVIRONMENT AND DEVELOPMENT AFFECT COCKROACH AGGREGATION?

***Linda Ali,*** and Dr. Scott Kight
Department of Biology and Molecular Biology
Montclair State University, Montclair, NJ

Aggregation is a behavior that results in the formation of a group of conspecifics in close proximity. In arthropods, aggregation may increase survival by reducing water evaporation. This study investigates aggregation behavior in light and dark-mediated environments in Turkestan cockroaches (*Blatta lateralis*), an invasive species in the southwestern United States. We used binary and free choice arena tests to examine patterns of aggregation of adult females and fourth and fifth instar nymphs. Aggregation behavior occurred more often in illuminated environments compared to dark environments, especially among immatures. The nocturnal nature of cockroaches, as well as negative phototaxis, may be important for inducing group formation. Maternal behavior, however, may increase aggression among females, which in the present study might explain decreased aggregation in some trials. The study also suggests that group size may influence aggregation behavior.

## COMPETITIVE BODYBUILDERS ARE AT RISK FOR DEVELOPING BINGE EATING DISORDER

***Kelly Davidson*[1]**, and Dr. Julie M. Fagan[2]
[1]Department of Nutritional Sciences, Rutgers University, New Brunswick, NJ
[2]Department of Animal Sciences, Rutgers University, New Brunswick, NJ

Competitive bodybuilding has gained popularity with the number of competitions doubling in just four years. Following competitions, bodybuilders have reported on social media that they consume a large amount of food in a short period of time and experience binge eating episodes weeks and sometimes months following a competition resulting in significant weight gain.

An online survey was developed to examine the prevalence of binge eating in competitive bodybuilders and to determine the factors which predispose individuals to developing a binge eating disorder (BED). Of the 699 competitive bodybuilders that took the survey, 440 were female and 259 were male. Results indicated that 71.22% of females and 59.69% of males reported struggling with binge eating post-competition. Bodybuilders reported a wide range of weight gained (from 1-60 pounds after just one month of competition). There was an average weight gain of 9.69% (of competition weight) within a month following the competition. Weight gain as a percentage of initial body weight was not significantly different in men and women. Females experienced binge eating behaviors lasting significantly ($p<0.05$) longer than males with 22.06% of females exhibiting binge eating behaviors lasting at least 6 months compared to 9.86% of males. Those that struggled with post-competition binge eating fit the criteria for sub-threshold BED and bulimia nervosa as defined by the Diagnostic and Statistical Manual of Mental Disorders-IV. Comorbid with the BED was a high prevalence of depression post-competition (72.59%). Only a small percentage of individuals sought professional help in order to manage their behaviors, with the number of males seeking help being significantly ($p<0.05$) lower (7.25%) than females (18.41%).

We hope that our study alerts those considering becoming a competitive bodybuilder of the potential downside of developing a BED (and potentially reconsider doing this activity at all). The results of our study are also relevant to those considering restricting their diets and may explain, in part, the weight gain seen after going off specific diets.

Strategies for the prevention and management of these behaviors should be put in place before restricting one's diet. Knowledge of diet and non-diet related risk factors by coaches, health professionals and athletes who participate in sports emphasizing leanness, is warranted in preventing and treating BED.

## WHY IS RECYCLING IMPORTANT?

***Ashley DeMaria***, and Dr. Antonia Florio
Department of Biology
St. Francis College, Brooklyn, NY

Recycling is converting waste into reusable material, and it can be used as a way to combat, as well as, bring awareness to environmental issues. The goal of this study was to learn why some people recycle and why others choose not, and then to use this knowledge to guide recycling decisions on my college campus. We surveyed 200 individuals in the following age ranges: younger than 18, 18-24, 25-39, 40-60, and 60 plus. The respondents associated with a religion (Christianity, Judaism, Hinduism, or Buddhism), they chose not to respond, or they did not associate with a religion. Respondents were asked to specify their ethnicity given the following choices: White, Hispanic/Latino, Black/African American, Asian/Pacific Islander, or they could choose not to respond. Respondents were also asked to specify the highest degree of education from the following choices: High School/GED, in pursuit or completed Bachelor's degree, Master's Degree and Doctorate Degree.

We found that most respondents recycle because it reduces waste in our society (35.05%) and that they would recycle more if recycling containers were more readily available (41.12%). The results also showed that religious affiliation does not seem to affect views on global climate change, with both about equal amounts (25%) of non-religious and Christian individuals relating the importance of recycling to combat global climate change. Lastly, we found that there is a trend where age (in individuals <18 to 60) mostly correlates with whether you are more likely to purchase a more expensive, environmentally-friendly product. Interestingly, this pattern does not hold in individuals aged 60 or over, where the reverse was found to be true. From these results, I hope to provide a date driven solution to a recycling problem on my college campus.

## THE EFFECT OF MIRROR THERAPY ON REHAB PATIENTS

***Maria Duardo***, Gaby Fahmy, M.D., PhD.
Department of Natural Sciences
Felician University, Lodi, NJ

Mirror visual feedback, an occurrence when movement of a body part is observed as movement of the other limb, can improve the pain and promote motor recovery of the affected extremity. Perceiving an image of an affected limb through the mirror significantly has an impact on regaining proper function of the affected area as well as improved posture. The objective of this study was to evaluate the efficiency of mirror therapy on rehab patients. In this study, we incorporated a mirror into the treatment plan for several rehab patients. A group of 10 patients with various conditions were assigned to a therapist and had mirror therapy incorporated into their treatment session. Sessions consisted of 30 minutes-1 hour a day for 3 days a week, for a 4-week period. Over the course of the experiment exercises were performed in front of either an individualized mirror on wheels or a wall mirror. Here we examined the performance and motor recovery

of patients while performing various movements via their reflection from a mirror. Upon treatment, results from the group showed an improvement on the affected upper and lower extremities, as well as reeducating proper body mechanics.

## COMPARISON OF INDIVIDUAL BEHAVIOR AND SOCIAL DYNAMICS BETWEEN CAPTIVE PENGUIN SPECIES AT ZOOLOGICAL PARKS AND AQUARIUMS

***Marisa Grisaffi*** and Dr. Brian Olechnowski
Department of Biological and Allied Health Sciences
Becton College, Fairleigh Dickinson University, Madison, NJ

Penguins have been studied extensively in the wild, but not much is understood in terms of their behavior in captive environments such as zoological parks and aquariums. The goal of this study is to examine the behavior of different species of penguins in these captive settings. We then correlate these behaviors to both penguin morphology and the biogeographic areas in which each species lives naturally. Additionally, African penguins will be used as a proxy species to test the effects of enclosures on captive penguin behaviors. Seven different species of penguins are examined in this study. We hypothesize that penguins from warmer climates will spend more time in the water, because swimming can be used as a cooling mechanism as well as a means of transportation to avoid predation. We also expect to see increased aggression in exhibits that house multiple species from overlapping niches due to competition for resources. Specific behavioral patterns for different species are also expected to be noticed in captivity based on behaviors in the wild. We predict that Gentoo penguins will show a higher frequency of vocalization. King penguins will demonstrate higher frequencies of vocalization and social interaction. Chinstrap penguins will exhibit higher frequencies of swimming and less interspecific interactions. For our comparative enclosure study, we expect to see excessive preening in smaller enclosures because this behavior is indicative of stress. We also expect to see higher frequencies of swimming in African penguins housed in outdoor enclosures due to a larger need for temperature regulation. Individuals of each species were sampled at ten second intervals for ten minutes each (n=158, total birds observed). Some birds were observed twice and the frequencies of their behaviors over the observation periods were averaged. Both walking and feeding behavior varied significantly between the different species. Penguins from colder climates showed significantly higher frequencies of walking and feeding when compared to penguins from warmer climates. There were no significant differences in behavior between penguins housed indoors and outdoors. African penguins housed in larger enclosures showed higher frequencies of swimming behavior, where African penguins housed in smaller enclosures showed higher frequencies of mutual preening and resting behavior. It is important to understand whether captive environments have a negative effect on animal behavior. This ensures exhibits are constructed to meet the welfare needs of captive animals. Further study is needed to understand the complexity of penguin behavior in various captive environments.

## HORMONAL AND NEUROANATOMICAL CHANGES ASSOCIATED WITH RODENT PAIN BEHAVIORS

***Danielle Hagee, Katherine LoMauro***, and Dr. J.W. Lee
Department of Biology
William Paterson University, Wayne, NJ

Injury is coped innately by behavioral avoidance. There are several neurochemical compounds that may aggravate or alleviate the magnitude of pain sensation by modulating the nociceptive signal either at the neural or hormonal level. The use of analgesics are of great importance in the clinical setting for their efficacy in suppressing the pain, albeit the presence of associated debilitating side effects. The present study examined the role of endogenous opioid-like compound producing gland on modulation of chemically-

induce aberrant sensory stimulation. Twenty C57BL/6J male mice underwent surgical procedure to remove the endogenous tissue. Control received sham surgery. One week post-surgery, all mice underwent chemical sensory stimulation. Behavior was recorded digitally and analyzed by observe blind to the treatment type. Brains were also removed and processed for immunohistochemical analysis. Our data showed marked changes in cerebral biomarkers as well as statistical difference in chemical sensory test between the surgerized and the sham groups. Internal organs play critical role in homeostatic balance to injurious tissue damage.

## THE BIOLOGY OF DESIRE: NEUROTRANSMITTER MEDIATED BEHAVIOR IN CHERRY SHRIMP (*NEOCARIDINA DAVIDI*)

***Molly Mancuso*[1], *Carla Granda*[1], Kayla Adams[1],** and Dr. Joseph Stout[1]
[1] School of Natural Sciences
Fairleigh Dickinson University, Teaneck, NJ

Dopamine (DA), a naturally-produced neurotransmitter, is commonly associated with desire and goal-directed movement, or seeking, behavior in vertebrates. Cherry Shrimp (*Neocaridina davidi*), a type of freshwater crustacean, were used to test this behavioral model in invertebrates. Initial expectations were that, when given exogenous DA, stereotypical seeking behavior would commence and movement would increase. When Cherry shrimp were given food, movement increased, but when given exogenous DA, movement was inhibited, prompting a reexamination of vertebrate models. Vertebrate models used in studies of addiction concluded that DA was the goal of seeking, rather than the cause. This new understanding allowed for an explanation for the inhibition of movement caused by the DA. Haloperidol (HA), a known DA blocker, was given in succession with dopamine and was able to show a restoration of movement in the Cherry shrimp. Monosodium Glutamate (MSG), a neurotransmitter associated with flavor, was used in conjuncture with preliminary food-based experiments and showed an increase in movement. Various combinations of DA, HA, and MSG were also tested. MSG+DA produced similar results to Food+DA, inhibiting movement, while MSG+HA increased movement. MSG+HA+DA restored some movement, falling between the MSG+DA and MSG+HA tests. Overall, the results were able to provide evidence that dopamine is the goal, or reward, of seeking, rather than the cause of seeking. Coinciding with vertebrate models, these findings have potential ties to the evolutionary development of neurotransmitters in all organisms.

## KCNQ $K^+$ CHANNELS AS A PHARMACEUTICAL TARGET FOLLOWING A TRAUMATIC BRAIN INJURY

***Nicholas Scibetta*** and Dr. Sonya M. Bierbower
Biology Department
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This research aimed to identify novel approaches to reduce neurological deficits associated with traumatic brain injuries (TBIs) caused by blunt brain trauma. The focus was on neurons, specifically on inherently neuroprotective KCNQ $K^+$ channels which control electrical activity, providing a specific target for preventative treatment. To test the effects of KCNQ channels, analysis focused on the identification of behavioral deficits in a long-term study after a traumatic brain injury; this type of injury would be analogous to that sustained in a motor vehicle accident or sports injury. Our traumatic brain injury model consistently

induced the injury by a controlled cortical impact to the parietal cortex in a mouse model. We examined the effects of the KCNQ channels by either treatment with a drug (retigabine) that opens the channels or a control group not receiving the drug. Retigabine exhibits unique anti-excitatory properties by its inhibition of neuronal action potentials. This effect on the KCNQ channels causes a hyperpolarized neuron that ultimately reduces hyperexcitabilty and subsequent excitotoxicity of neurons following a traumatic brain injury. The extent of injury was evaluated by behavioral and histological analysis; specifically, behavioral analysis included behavioral models aimed to test fear and anxiety one week post-TBI (acute) and at monthly intervals up to a six month time period (long-term). Histological analysis examined brain injury area and cellular swelling.

## ASSOCIATION OF DEMOGRAPHIC AND ENVIRONMENTAL FACTORS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER IN THE UNITED STATES

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Average diagnosed Attention Deficit/Hyperactivity Disorder (ADHD) of 2003, 2007 and 2011 for children aged 4-17 reported to US Centers for Diseases Control and Prevention were studied for the 48 contiguous US states. The state average ADHD percentage was compared with the state average family income, population demography, family size, percentage of smoking, pesticide applications and precipitation in the 48 states. Percentage of ADHD has significant positive correlations with state average precipitation, proportion of African American population and percentage of smoking (correlation=0.52, 0.51, 0.45 respectively and significance levels all p=0.00). ADHD percentage has positive but statistically insignificant correlations with state average percentage of pesticide application and proportion of white population. ADHD has significant inverse correlations with the state average proportions of Hispanic and multi-race population, average family size and proportion of Asian population (correlation=-0.59,-0.48,-0.47, -0.4 respectively and all p=0.00). Average house-hold income has inverse but statistically insignificant correlation with the ADHD percentage. Hence, ADHD is a problem related to genetic, social economic and environmental factors.

ADHD is a brain disorder of the neurodevelopmental type. People with ADHD tend to have trouble focusing on tasks and sitting still. The symptoms can begin in childhood and can continue into adulthood. Without treatment, ADHD will be a serious burden for the individual, family, school and workplace. Average percentage of ADHD in 2003, 2007 and 2011 for children 4-17 years old are 9.4% in the 48 US states. This implies that 1 in every 10 US school-aged children was diagnosed with ADHD. In 2011, the report has about 1 in every 5 high school boys and 1 in every 11 high school girls and roughly a total of 6.4 million children having ADHD. The increase between 2003 and 2011 in the US is about 40%. ADHD occurrences concentrated along the southern and eastern states. Kentucky and Louisiana have the highest ADHD prevalence rate at more than 13% and Nevada and California have the lowest ADHD prevalence rate at ~6% among their 4-17 years old children.

## CELLULAR DAMAGE INVESTIGATIONS DUE TO VARYING SEVERITY OF TRAUMATIC BRAIN INJURY

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Traumatic brain injury (TBI) results from an external force applied causing injury to the brain. It is commonly caused by violence, vehicle collision, construction, war and sport accidents. After a TBI, many metabolic pathways are initiated that results ultimately in cell death. TBI can vary from short to long term symptoms while leading to permanent functional impairments similar to Parkinson's disease. Most common symptoms include anxiety isolation, depression, antisocial behavior and cognitive dysfunction. This study identifies targets for treatment after TBI with the intent of reducing the brain injury cell damage. M-Channels are voltage-gated K+ channels present in neurons which play a role in controlling overall cell excitability. It has been shown that opening of M-channels leads to acute neuroprotective effects. Retigabine (RTG) is an anti-epilepsy drug that is specific to M-channels by reducing hyperexcitability; thus, reducing neuronal death due to excitotoxity. This study induces a TBI in mice using a controlled closed cortical impact (CCCI) device which allows for a precise and reproducible injury. Furthermore, examination of cell death with increasing severity of TBI provides insights into possible therapeutic targets. Cell death and cognitive impairments were assessed by a variety of behavioral tests as well as histological analysis on brain injury area.

## INDUCING RNAI IN *C. ELEGANS* BY USING *E. COLI* TO DISRUPT THE *UNC-22* GENE AND DISTINGUISH THE GENE'S CORRESPONDING MUTANT PHENOTYPE

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The mechanism of RNA interference (RNAi) encompasses silencing a certain gene function while still maintaining its genomic integrity. According to a Nobel prize-winning study that began in 1998, triggering gene silencing is made possible by feeding special strains of bacteria (*E. coli*) to the *C. elegans* worms. Each of the bacteria contains a plasmid expressing a gene-specific double-stranded RNA (dsRNA), which is then "absorbed" by the worm. Once the dsRNA is present within a cell, the protein RNase Dicer cuts the dsRNA into two small interference RNA's (siRNA). One siRNA strand is destroyed and the other strand is hybridized to a complementary mRNA while bound to Argonaute, a protein that plays a central role in the RNA silencing process. Then, the remaining siRNA and complementary mRNA strands are bound and the Argonaute cleaves them within the complementary sequence. The gene function, therefore, is silenced.

## USING *C. ELEGANS* AS A MODEL SYSTEM TO IDENTIFY GENES THAT FUNCTION DURING THE PROCESS OF CELL MIGRATION

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Cell migration is an important process involved in the development and maintenance of multicellular organisms. Abnormalities in cell migration can lead to numerous diseases, including intellectual disabilities and some cancers. Though numerous cell migration pathways have been identified, the mechanisms governing their function remain unclear. We are interested in identifying genes that function in the WAVE/SCAR pathway known to regulate cell migration during embryonic and neuronal development. WAVE has been linked to numerous neurodegenerative diseases and different cancers. Embryos in the nematode *Caenorhabditis elegans* fail to develop properly when WAVE pathway genes are mutated. These embryos die because the epidermis fails to migrate properly and enclose the internal organs. We employ *C. elegans* as a model system to identify novel genes functioning in this pathway. We have a 2000-clone RNAi library of genes functioning in *C. elegans* development. By feeding RNAi to *C. elegans*, we can silence gene expression. To identify new WAVE pathway genes, we fed the RNAi to a known WAVE pathway mutant, *sax-3/robo*. SAX-3 mutation leads to 40% dead embryos, which can be visualized using a Dissecting microscope. Therefore, we screened for genes that enhance *sax-3* embryonic lethality to more than 60%. We screened 300 genes and identified approximately 12 enhancers of sax-3. The enhancers include genes known to function in various cellular processes. These include genes functioning in neurons, muscle contraction, embryogenesis and apoptosis. Understandings how these genes function will help to clarify the mechanisms through which WAVE affect cell migration.

## MITOCHONDRIAL INHERITANCE IN *SACCHAROMYCES CEREVISIAE* SEPTIN MUTANTS

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*Saccharomyces cerevisiae* (commonly known as budding yeast) is a single-celled eukaryote that is frequently used as a model organism in scientific research. The purpose of this research was to study mitochondrial inheritance in *cdc3* septin mutants. CDC3 is an essential gene that codes a septin. When a septin mutant is grown at elevated temperatures (37°C), one can observe abnormal bud growth, an inability to complete cytokinesis, and the formation of large budding chains. By comparing mitochondrial localization in wild type versus *cdc3* mutant yeast, one can determine whether or not septins affect mitochondrial inheritance between the mother and daughter cells.

Mitochondria were stained using MitoTracker Red CMXRos. Cells were first being stained in a 30 nM solution of MitoTracker. Later on, it was discovered that high concentrations of MitoTracker and long incubation times were harmful and could cause damage to mitochondria. As a result, the staining procedure was altered to use a 15 nM solution of Mitotracker and the incubation time was reduced. The previous data collected could not be included in the results.

Cells were categorized based on their cell cycle phase and the cellular location of their mitochondria. Wild type cells with CFP tagged mitochondria were also observed. Results showed that wild type yeast in the G1 phase had mitochondria concentrated in the cell cortex or evenly spread throughout the cell body. Yeast in the S phase, had mitochondria localized in the bud neck *and* cell cortex. Yeast in the G2/M phase, had mitochondria at the bud neck with a trail to the cell cortex across the cell body. In addition to normal localization, when using MitoTracker in wild type cells, bright spots were observed in the background of the MitroTracker images. These bright spots were absent in the CFP images. To characterize how much of the background was due to the Mitotracker, the bright spots observed in the MitoTracker versus CFP pictures were quantified and compared.

Results also showed that when the septin mutants were grown at 37°C (a temperature at which the mutant phenotype is expressed), there was abnormal mitochondrial localization. Instead of the typical filamentous network of mitochondria, there were punctate spots of mitochondria. These results suggest that septin mutants defects in cytokinesis cause the mitochondrial matrix to collapse. Future research will involve observing cells with a ER-GFP tag along with MitoTracker. This will allow for the observation of colocalization of the ER and mitochondria.

## ESTABLISHMENT OF OPTIMAL MC3T3 OSTEOBLASTIC DIFFERENTIATION CONDITIONS

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Bone is a dynamic tissue maintained by the interactions of many cells and many signaling pathways transmitting information both within and between them. However, in order to better study these signaling pathways, it is often more useful to use cells in culture so that they can be manipulated on the biochemical and genetic levels and the effects of these manipulations determined. We are specifically interested in using the osteoblastic cell line MC3T3 which is one of the few cell lines which can differentiate completely and generate mineralized bone nodules. We are particularly interested in being able to both overexpress and silence the Sit-1 and c-src genes in this system. Based on the literature and on our lab's data, overexpression of these genes will probably increase osteoblast differentiation while silencing them will lessen differentiation. To eventually demonstrate these changes, we need to establish culture conditions under which we can drive the MC3T3 cells to differentiate very well so that when these genes are silenced, we will see a decrease in mineralization. In contrast, we also need to establish conditions under which the cells differentiate rather poorly, so that when the genes are overexpressed, we will be able to observe a large induction. We are currently emphasizing the use of ascorbic acid-free MEM alpha medium to grow the cell initially followed by differentiation medium containing ascorbic acid and B-glycerophosphate. Differentiation is being monitored by assessing the alkaline phosphatase enzyme and bone phenotype marker genes whose activity should increase with differentiation, as well as by ultimately measuring the formation of mineralized bone nodules.

## USE OF CRISPR/CAS-9 GENOME EDITING TO GENERATE POINT MUTATIONS IN THE RAT SIT GENE

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SIT is a protein previously shown to be involved in regulating bone mass in rats (comparison of wild type and osteopetrotic) and in mice (gene deletion). Prior to our work, it was known only to regulate the function of the T-cell receptor in the immune system where tyrosines in its intracellular tail are phosphorylated by members of the c-src family of kinases. Interestingly, deletion of the c-src gene itself also results in the osteopetrotic bone phenotype, raising the possibility that the c-src kinase might phosphorylate the SIT protein in osteoblasts. Comparison of SIT between humans, rats, and mice finds that three of the tyrosines (rat Y72, Y109, and Y151) are in YxxL/V motifs for phosphorylation-dependent interaction with SH2 domains of src family kinases and that these tyrosines are conserved across species. In order to help begin to establish SIT's role in bone formation, we want to mutate each of these three tyrosines to phenylalanine and investigate the consequence of the substituted amino acid on bone cell differentiation. We are using the Crispr/Cas9 gene editing system to do this and chose Y109 as our first target. A guide RNA close to the codon for Y109 was chosen and oligonucleotides encoding it were cloned into the Crispr-Cas9 plasmid PX458. This cloning was confirmed by DNA sequencing. Unlike efforts to delete a gene using this technology where the error-prone Non-Homologous End Joining pathway for cellular DNA repair is favored in order to introduce large mutations, making point mutations relies on the high-fidelity Homology Directed Repair pathway. For our work, a repair template oligonucleotide containing the single nucleotide change (for Y109 = TAC > TTC) will be introduced into ROS 17/2.8 cells together with the PX458 plasmid containing the guide RNA. Following drug selection for transfectants, the region of the SIT gene surrounding the Y109 codon will be sequenced to determine if the point mutation has occurred.

## ANALYSIS OF P53 FUNCTION IN NEUROBLASTOMA CELL LINES

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Cancer is an insidious disease caused by abnormal mutation in an otherwise normal, healthy cell. Mutations that modify the functionally normal cell cycle regulator gene, p53, can result in uncontrollable cell division leading to cancer. Recent studies report SN-38, a DNA damaging agent, in combination with checkpoint inhibitor UCN-01, to be an effective therapy to target p53 defective tumors. Levesque et al[1] further reports wild-type p53 tumor cells to be sensitive to subsequent treatment possibly due to defective p53 function. Our present research aimed to continue analysis of wild-type p53 checkpoint sensitivity using three neuroblastoma cell lines. Specifically, wild-type SK-N-AS, LAN-5, and CHLA-90 cell lines were used to gain further evidence.

To investigate this, each cell line was incubated in SN-38 for 24 hours and subsequently treated with UCN-01 inhibitor for 6 and 24 hours. SK-N-AS, LAN-5, and CHLA-90 lines were then harvested for flow cytometry to analyze cell cycle arrest and treatment sensitivity. Samples were further harvested for western blot analysis to analyze protein expression in response to our treatment. Glutaraldehyde crosslinking was further employed to analyze defective p53 function in relation to inadequate oligomerization. Our results

ultimately analyze wild-type p53 sensitivity to our subsequent combination treatment and its relationship to defective p53 oligomerization.

1. Puli P, Lipski R, Levesque AA. Oligomerization status of p53 serves as an indicator of sensitivity of p53 wildtype tumors to the therapeutic combination of DNA damaging agent and checkpoint inhibitor. *American Association for Cancer Research.* 2016;76(14):3683.

## POST-TRANSCRIPTIONAL PROCESSING OF THE MITOCHONDRIAL ATP8 GENE: A POTENTIAL CAUSE FOR S-TYPE CYTOPLASMIC MALE STERILITY IN MAIZE

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CMS is a maternally inherited trait that prevents the production of viable pollen. This phenotype is usually associated with the expression of a chimeric region within the mitochondrial genome. These chimeras arise from genomic rearrangements that are due to recombination events among the multiple repeat regions typical of plant mtDNA. Mitochondrial biogenesis and gene expression is determined by nuclear-mitochondrial interactions and the CMS phenotype can be suppressed by nuclear restorer-of-fertility (Rf) genes. Most Rf genes have been found to be within the large family of RNA editing pentatricopeptide (PPR) genes. Their action is consistent with CMS phenotypes being associated with post-transcriptional changes that affect protein accumulation. A reduction in accumulation the ATP8 protein, a subunit of mitochondrial ATP synthase, has been observed during pollen development of maize CMS-S cytotype as compared to pollen development in plants with a normal fertile cytoplasm. We examined the published whole genome sequencing of the maize mitochondrial genomes. The results showed the atp8 locus is downstream of an open reading frame locus, orf-111 and a short intergenic sequence. This organization has potential for the atp8 locus to be expressed as a chimeric locus that would be consistent with most CMS systems. We are conducting cDNA analysis to examine the expression and processing of this region of the maize mitochondrial genomes from normal and CMS-S cytotypes. We will be reporting on RNA editing and processing results revealed by PCR products and sequencing analysis and their potential effects on ATP8 accumulation during pollen development.

## DETERMINING THE EFFECTS OF A WESTERN DIET ON THE DISTRIBUTION OF MICROGLIA WITHIN CEREBELLAR CORTEX OF NPC1 MUTANT MICE

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~~**Abstract**~~

Neimann-Pick Type-C (NPC) is a very rare autosomal recessive lysosomal storage disease that is marked by progressive neurodegeneration, ataxia, memory loss and premature death. Neurodegeneration due to NPC1 mutation is most prevalent in the cerebellum. The degeneration has been linked to accumulation of lipoprotein-derived cholesterol within the endosomal-lysosomal system of the neuron. Neurons affected by the NPC1 mutation cannot utilize the cholesterol for the production of vital steroid hormones and plasma membrane function, leading to cell death. Although it is known that ~~the cholesterol provided to the neurons are from low-density lipoproteins (LDL)~~astrocytes within the brain tissue provide neurons with cholesterol

in the form of apolipoprotien E,~~,~~ there is no research on whether ~~an increase in LDL from diet habits~~ an increase in dietary cholesterol in the form of LDL's ~~will~~ may also affect~~lead to~~ the progression of neurodegeneration by the NPC1 mutation. In this study, the main goal was to determine the effects of a high fat "Western Diet" (WD) on the progression of microglia migration through the cerebellar layers of NPC1 mutated mice. Mutant mice given the Western Diet were examined at 8 weeks of age to examine the distribution of microglial cells through the lobe and layers of the cerebellum. The WD mutant mice were then compared to mutant mice that received a monitored "Regular Diet" (RD) for the same age. Microglial cells were immunostained with IBA1 and CD68, which are specific markers for these cells and for activation respectively. Our results suggest that the distribution is altered by the western diet in NPC1 mutated mice, predominately in the granular cell layer.

## AN INVESTIGATION OF SPATIAL POSITIONING AND THE CONSERVATION OF ADJACENT CO-REGULATION WITHIN TOXIC RESPONSE GENES IN *SACCHAROMYCES CEREVISIAE*

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Transcriptional regulation is essential to cellular survival, which is especially true for single cell-eukaryotic organisms. In response to stress or exposure to potentially toxic agents (such as arsenic) the cell needs to alter the transcriptome to survive and establish a new homeostasis before progressing with the cell cycle. One under-explored mechanism regulating the transcription of the toxin response genes is that of genomic positioning. My project is to explore the conservation of adjacent co-regulation as a regulatory mechanism for toxic response genes using the budding yeast, *Saccharomyces cerevisiae* as a model system. My current project explores the scope of adjacent gene co-regulation within toxic response genes, focusing initially on the gene pairs *THI13-AAD4* and *SOR1-MPH3*. We will be focusing on the effects that their promoters have on the gene pairs as well as neighboring genes. We are targeting the identified TF promoter elements for mutation in order to characterize the relationship between genomic positioning and adjacent gene co regulation as regulatory mechanisms for transcriptional cues.

## BENTONITE EFFECTS ON MICROBIAL COMPOSITION

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A widely used product in remediation projects is the commercial product AquaBlok$^{TM}$. Aquablok is clay pellets composed of Bentonite, which is an absorbent aluminum phyllosilicate clay consisting mostly of montmorillonite. Due to its high ionic capacity, bentonite is able to remove most water contaminants. Six, thirty gallons containers were set up using either soil or soil/bentonite as substrates. Each container was filled either with plain tap water or with Hackensack River water. Excess nitrogen and organic phosphate in the Hackensack River has been an important factor in abnormally large levels of bacteria found in the river water. After a period of 12 weeks, bacteria samples were collected from substrate and water from each container and compared for their content. Each bacteria sample was plated under aerobic and anaerobic conditions. Each plate was analyzed after 24 hours and single colonies were isolated and characterized. Observations show that containers using bentonite as a substrate had a decrease in water microbial numbers and composition. Conversely, results shows an increased in the number of microbes and composition especially under anaerobic conditions present in the bentonite substrate when compared to plain soil.

## PREHISTORIC HUMAN CULTURAL SHIFTS IN THE MID-ATLANTIC: EVIDENCE OF CLIMATE INFLUENCE ON ARCHAIC CULTURES IN NEW JERSEY INFRERRED FROM A 15,000-YEAR LAKE SEDIMENT CORE

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We present a local lacustrine record from Lake Blauvelt (LB), Franklin Lakes, New Jersey, which records past regional climate variability since ~15,000 years before present (kyr). Several paleoclimate proxies of regional lake recharge, weathering, and vegetation activity were extracted from the core at 3-4 cm increments (~50-100-year temporal resolution) and include analyses of sediment grain size, organic carbon and nitrogen content, nitrogen and carbon isotopes, and paleomagnetism. These proxies reveal similar patterns of variability throughout the record, whereby periods of larger-grained sediment input into the lake were synchronous with higher organic carbon and nitrogen fluxes (and vice versa), indicating both proxies likely reflect changes in lake recharge and weathering rates. These patterns are validated by similar Holocene patterns in C/N, magnetic susceptibility, and sedimentation rates. Together, the data indicate the Younger Dryas epoch (~12.8-11.5 kyr) was characterized by generally dry conditions, which culminated with a rapid transition to increased lake recharge during the early Holocene (~10 kyr). Superimposed upon a general increasing trend in LB lake levels throughout the Holocene is a major step-change at ~4.5-5 kyr, signifying an abrupt transition to higher lake levels that is matched by increased storm frequency in New England and declining regional air temperatures. These patterns are coeval with an abrupt increase in temperatures in the Pacific Northwest and tropical Eastern Pacific, indicating a strong role for the Pacific Decadal Oscillation (PDO) in this shift.

This proxy data when combined and analyzed serves as a context for the study of human culture in the local area from the Paleo-Indian Period to the Late Woodland Period, detailed within. Rather than using just publicly available $C^{14}$ dates, our study hopes to bring greater light to “gray literature” and collections, at least in northern NJ. The addition of new archaeological data from the region may help in creating a centralized database or foundation for research of settlement patterns as well as the establishment of trade networks and technological shifts in northern New Jersey.

## DETRIMENTAL IMPACT OF COMBINED SEWER OVERFLOWS ON WATER QUALITY AT SELECTED LOWER HUDSON RARITAN ESTUARY SITES

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Regular wastewater is a collection of rainwater runoff, domestic sewage, and industrial waste that collects in a single pipe to a sewage treatment plant, and then discharges to a water body. Excess wastewater after

rainfall leads to combined sewer overflows (CSOs) that contain untreated or partially treated waste with high toxicity and increased pathogenic bacterial concentration. Therefore, CSOs have a high impact on water quality leading to impaired aquatic habitats, compromised drinking water supplies, and endangered human health. Our project focused on studying the concentrations of pathogenic bacteria at selected lower Hudson Raritan Estuary (HRE) sites in correlation with the location of nearby CSOs and rainfall events as well as salinity and PH of the water. To this end, weekly scientific testing and monitoring of water quality were conducted in the designated lower HRE sites for a period of 10 weeks. Modern bacterial identification techniques were used in the laboratory to determine the concentration of fecal coliform bacteria, a high concentration of which is indicative of poor water quality, as well as the concentration of Enterococcus bacteria, an indicator organism for the presence of potential disease-causing organisms. The results of this study will not only inform management practices but will also become an important resource for decision-makers to advance environmental protection.

## GENERATING NEW ULTRA-SENSITIVE TEMPERATURE RECONSTRUCTIONS IN MONGOLIA USING BLUE INTENSITY REFLECTANCE

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Latewood density information derived from the intensity of blue light reflectance (BI) of the latewood portion of tree rings is a new method of tree-ring analysis that strongly correlates with instrumental summer temperatures. In many cases, tree ring density derived from BI captures a stronger climatic signal compared to the measurement of ring width, which is typically used in dendroclimatic studies. Mongolia is a country in central Asia with a semi-arid climate, and has been rapidly warming, leading to an influx of drought conditions. Knowledge of past climatic conditions is limited due to sparse meteorological records. The purpose of this study is to improve existing dendroclimatic records in this region by analyzing previously studied sites in Mongolia with the BI method, and to determine if there are differences between response among tree species. We focus on developing BI records from Siberian pine and Siberian larch from Solongotyn Davaa (Sol Dav), a timberline (2420 m) site in the Tarvagatay Mountains. Hundreds of tree core samples have been revisited for analysis using BI. We find that BI has a stronger climate signal then RW and will result in a millennial length temperature reconstruction that was not previously possible using RW alone. Thus, the scientific community will be able to better understand the long-term context of millennial scale variability and recent rapid warming in Mongolia. Understanding Mongolia's past and present climate is crucial for the region and for its people to understand the possible climatic conditions that may occur in the future.

## RECONSTRUCTING SURFICIAL GEOLOGY IN THE NORTHERN NEW JERSEY PIEDMONT UTILIZAING FOSSILIFEROUS GLACIAL ERRACTICS FROM THE LOWER AND MIDDLE DEVONIAN OF EASTERN NEW YORK

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Large fossiliferous glacial erratics occur scattered within ground moraines throughout Passaic and Bergen Counties in the northern New Jersey Piedmont. The distinct lithology and fossil assemblages identified within these glacial erratics indicates that the source provenance resides in the Lower and Middle Devonian of the Lower Hudson Valley and Helderberg Mountain Regions of New York State. The glacial erratic assemblage is dominated by siliciclastic and impure carbonates that are physically and chemically resistant to glacial erosional processes. Diagnostic invertebrate fossils including: brachiopods, mollusks, corals, trilobites, crinoids, and tentaculites indicate that most formations occurring within the Helderberg Group, Tristates Group, Onondaga Formation, and Hamilton Group are represented. These fossiliferous piedmont glacial erratics provide a unique opportunity to reconstruct the travel path of the Hudson-Champlain Lobe of the Laurentide Ice Sheet. This travel path is due north to south and as much as 200 kilometers as delineated by Lower and Middle Devonian outcrop exposures and the recovered piedmont glacial erratics. Moreover, distribution of Lower and Middle Devonian erratics in the northern New Jersey Piedmont indicates that the Hudson-Champlain Lobe was channelized in topographic lows, between the Ramapo Mountains to the west and Watchung Mountains to the east, before ice melt and deposition.

## HYDROGEL APPLICATION AS A SAMPLING TOOL FOR BACTERIAL CELLS

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Biological terrorism became an important issue on October 12, 2001 when the U.S. capital was attacked with a highly infectious and deadly bacteria named *Bacillus anthracis*. Although it remains unseen to the naked eye, exposed individuals develop the fatal disease anthrax. In 2001, there was limited experience in detecting contaminating bacteria on surfaces. Although more than a decade has passed and surface sampling protocols have improved, there are still limitations with these methods. As a result, new tools, such as hydrogels, have been developed to combat these issues. A hydrogel is a water-soluble and environmentally-friendly polymer that forms a thin layer of gel when applied on a surface. This facilitates the collection of bacteria for analysis and identification. In this study, the effectiveness of hydrogels on gram-negative bacteria will be compared to current tools used in the biodefense industry for combatting microbial adulteration.

## SEASONAL VARIATION IN INNATE IMMUNITY IN THE RUBBER BOA (*CHARINA BOTTAE*)

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Environmental stimuli, including acute and chronic changes in temperature and photoperiod, can have substantial effects on vertebrate physiology. Ectotherms are especially influenced by seasonal variation in the thermal environment, due to their inability to generate significant heat endogenously. This work involved the exploration of components of the innate immune system of the Rubber Boa (*Charina bottae*) between two seasons, summer (active) and winter (hibernation). Blood samples were taken from active and artificially-hibernating snakes maintained in the laboratory, followed by immediate generation of blood smears via the bevel-edge slide technique. Smears were stained with a Wright-Giemsa solution, and the percentage of each leukocyte type was determined. Blood plasma was isolated (via centrifugation), and used in the conduction of an *in vitro* bactericidal assay. Solutions of plasma, $CO_2$-independent medium, and diluted *E. coli* were incubated at three different temperatures (7, 16, and 25°C) for 40 minutes. Samples were then plated in duplicate, followed by overnight incubation at 37°C. Resulting colonies were counted, followed by computation of the percentage of colony-forming units (% CFUs) killed relative to positive controls. Analysis of blood smears revealed a significantly elevated percentage of heterophils (the primary phagocytic leukocytes in snakes) and a significantly decreased percentage of lymphocytes during the artificial hibernation season. A significant difference in plasma bactericidal ability was also observed between seasons, with hibernation samples exhibiting lower % CFUs killed across all incubation temperatures. Finally, within each season, bactericidal ability increased with increasing acute temperature.

## SEALS AND THE CITY: PINNIPEDS ARE RETURNING TO URBAN WATERWAYS

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Urbanization has drastically changed the way in which species interact with their environment. Some generalist species thrive in highly modified habitats, whereas specialists may decline to the point of local extinction. One such group of animals, Phocidae, had once commonly inhabited the waterways of New York City; however, due to a number of potential interacting anthropogenic factors, their presence in this urban habitat was eliminated over a hundred years ago. Recently, the general public began to report sightings of individual seals at various haul out locations along the NYC foreshore. Given these reports, and our own preliminary questionnaire surveys, we conducted naturalistic observations of primarily harbor seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) between the wintering field seasons from 2011-2016. Here, we conducted both land-based and boat-based observations at Orchard Beach, and Hoffman and Swinburne Islands. Our results show that seal populations are fairly stable on an annual basis, with a slight increase in the total number of individuals between each field season. The stability in annual populations is encouraging, as it indicates that pinnipeds are indeed returning to previously used locations that are within their natural seasonal range. Moreover, the return of large megafauna to urbanized waterways suggests a likely positive change in ecosystem health – one that is equally favorable for supporting other interacting species.

## HABITUATED AND LEARNED RESPONSES TO ENVIRONMENTAL STIMULI IN BIRDS AND RELATIONSHIP TO OPTIMAL FORAGING THEORY

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While many studies have examined optimal foraging theory in birds, few studies have tied the concepts of learning or habituation in how birds choose when and where to forage. According to the optimal foraging theory (OFT), animals use information from environmental stimuli to predict the value of a resource patch and make decisions about how long to stay in the patch (i.e. for feeding, reproduction, etc). The goal of the animal is to try to minimize time to maximize energy. Learned and habituated responses may influence how birds accomplish this task. This research aims to examine how the presence of a proxy-predator, food quality and seasonal weather conditions affect bird behavior when foraging and competing with other birds at feeders. A feeder was set up in a forest-edge habitat at Fairleigh Dickinson University in Madison, New Jersey. At the feeder, the following data were obtained: species visiting the feeder, location of foraging (feeder or ground), duration of visit, and whether competition with other birds occurred during a visit. Our hypotheses are divided into three groups. Food variety: 1) More birds are present when higher food variety is in the feeder (different seed types); 2) Longer visits occur with higher variety food; 3) Greater species richness will occur with higher quality food; and 4) More competition will be present with higher quality food. Seasonal effects: 5) More individual birds are present at feeders in winter to reach satiation in order to gain the necessary energy to survive and stay warm; 6) More competition exists under these same conditions (#5) 7) A greater level of species richness will be observed in spring and fall as a result of migrants seeking food; 8) Longer visits will occur in winter season. Presence of owl proxy-predator: 9) Less feeding occurs when a decoy owl is initially presented; and 10) Feeding duration will increase as habituation increases. Overall, some hypotheses were supported. The number of visits to the feeder was significantly greater when high quality food was presented. However, the average duration of feeding was significantly longer when low quality food was presented. The average number of total visits and the average number of competitive interactions at the feeder was significantly greater during the Winter than the Spring. Finally, counter to our expectations, there were no differences in any of our response variables when the owl-proxy predator was presented. Our results indicate that there was no initial fear response or habitation. The results of this research help provide further insight into the complexity of optimal foraging theory. However, additional field research is needed to understand the link between predation risks, learning, and adaptive foraging behavior in birds.

## MACROPHYTE DIVERSITY AND WATER QUALITY IN SIX FINGER LAKES

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Aquatic plants are required for a healthy ecosystem by providing many necessary functions such as preventing shoreline erosion, producing dissolved oxygen, limiting algal overgrowth, and providing habitat for many aquatic organisms. As an indicator of water quality, assessing aquatic plant diversity can help assess ecosystem health. In

2007-2009, various surveys of submerged aquatic plants were conducted on six Finger Lakes in New York, which are oligotrophic lakes with low nutrient levels. This research project aimed to compare the aquatic plant diversity and abundance across the six Finger Lakes and test possible relationships between aquatic plant diversity and water quality. Plant species in the lakes varied from 13-19 species, with common species being elodea, Eurasian milfoil, curly-leaf pondweed and slender naiad. Eurasian milfoil, an invasive species, was the most abundant across the lakes, which may reduce growth and abundance of native plants. Trophic state index (TSI) was calculated using chlorophyll a, total phosphorus, and Secchi depth data from 2006-2008. The range of TSI was from 26.8 to 42.7, which further suggests that most of the sampled lakes are oligotrophic. Further investigation of the relationship between TSI and plant diversity measured as total species richness, average species richness per site, Shannon-weaver diversity index, and evenness, revealed no significant correlation. This is likely due to the narrow range of TSI and a small sample size. However, the average species richness tended to increase while TSI increased. This is consistent with the common finding that more plant species are present in mesotrophic lakes.

## THE INHIBITING EFFECT OF ESSENTIAL OILS AND METHYLGLYOXAL WITH CARRIER OILS ON THE GROWTH OF *PSEUDOMONAS AERUGINOSA*

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Due to global overuse of antibiotics, some bacteria have evolved to become resistant to drugs normally used to treat their respective bacterial infections. Since traditional antibiotics are ineffective to treat infections caused by antibiotic-resistant bacteria, alternative methods are sought to combat the emergence of these bacteria. One such method is the use of natural products derived from plants to effectively inhibit the growth of multidrug-resistant bacteria. Essential oils from plants are known to be highly potent and have natural antibacterial properties that may be useful to treat infections due to drug resistant bacteria. In this study, two highly potent essential oils, cassia and cinnamon bark, and the aldehyde methylglyoxal (the main active antibacterial ingredient in Manuka Honey) were used in conjunction with three carrier oils (olive oil, jojoba oil, and lanolin) to determine their efficacy in inhibiting the growth of *Pseudomonas aeruginosa*, a multidrug-resistant bacterium.*Pseudomonas aeruginosa* is a gram-negative, aerobic, and coccobacillus bacterium that infects open airways and wounds. *Pseudomonas aeruginosa* infections have become a serious problem for patients who have weakened immune systems. The Kirby-Bauer disk diffusion method was used to test the efficacy of the essential oil and carrier oil mixtures. The essential oils used were diluted to lower concentrations with carrier oils to determine their minimal inhibitory concentration (MIC) as essential oils can be irritating if used independently. The results were compared to colistin, which is an antibiotic normally used to treat *Pseudomonas aeruginosa* infections. The essential oils and methylglyoxal were diluted and tested at 100%, 75%, 50%, 25%, and 12.5% concentrations in carrier oils. The results were compared to the colistin for relative effectiveness. It was determined that at a 50% concentration, the essential oils and methylglyoxal were more effective than colistin in inhibiting the growth of *Pseudomonas aeruginosa* in the Petri dish experiments. The results show a potential topical treatment that can be used in health care facilities to effectively treat infections caused by this bacterium.

## CHEMICAL COMPARISON ~~Between~~ OF MODERN AND FOSSIL SHARK (LAMNIFORM) TEETH

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Shark teeth, both modern and ~~-~~fossil ~~prehistoric~~, can be grouped by differences in their hierarchical self-assembly. Based on these variations of ~~internal composition~~tooth histology, the designations carcharhiniformes (orthodont) and lamniformes (osteodont) can be determined. ~~By employing the methods of~~Using ~~various methods of~~ spectroscopic analysis ~~, like the~~ [including Fourier Transform Infrared Spectrophotometry (FTIR), S~~s~~canning E~~e~~lectron M~~m~~icroscopy with the E~~e~~lectron D~~d~~isruptive S~~s~~pectrophotometer (SEM/EDS), X-r~~r~~ay C~~c~~rystallography (XRD), and Nuclear Magnetic Resonance (NMR)~~ and Sigma Plot~~], this research aims to elucidate potential differences in the ~~, we were able to elucidate patterns of~~ crystallographic arrangement/properties of shark tooth bioapatite between various lamniform~~the enamel arrangement in lamniformes~~ (osteodont) species [1]. Specifically, ~~In this presentation~~ this work~~we~~ focuses on the characterization of modern lamniformes (osteodont) shark teeth as a standard to be comparative to their fossil ~~prehistoric~~ counterparts.

~~Being that t~~The ~~fluoroapatite~~bioapatite crystals that make up the outer layer of shark teeth (termed enameloid) are compacted in way that permits their physical and biochemical properties to be better preserved, compared with the more porous inner dentine. This~~e~~ enameloid is also ~~outer tooth layer – the enamel contains a tightly packed composition, it is capable of being preserved better overtime. It is also thus~~ less susceptible ~~subject~~ to chemical weathering and contamination, and therefore ~~hence~~ serves as the primary substrate ~~foundation~~ for this ~~analysis~~ study. Since the modern teeth have not undergone the process of fossilization, ~~years of weathering and drastic change,~~ they can potentially ~~thus~~ be used to better constrain the environmental (e.g. ambient ocean temperatures) and biological (e.g. endothermic versus ectothermic) effects on tooth mineralization. These modern tooth properties of warm and cold water lamniform species can then be used to compare and contrast chemical variability with teeth of their fossil counterparts. ~~With this in mind, we will as a standard for this study. Keeping this in mind, we could then compare and constrast the variability in modern tooth properties of warm and cold water species them againstwith the teeth of their their prehistoric counterparts fossilized teeth. , and examine how closely they differ/compare based on variance in mineral composition.~~ Whil~~e~~st focusing primarily on the Lamniform osteodont species, results of this work may set the stage for improved understanding of where the infamous '~~we could then examine where the infamous~~ Megalodon' ~~falls~~ resides in~~to~~ the cladistics tree, based on similarities in crystalline structure, and composition spectra.

[1] Kesmez, M.; Lyon, J.; Cocke, D. L.; Westgate, J.; McWhinney, H.; Grady, T. L. Characterization of the Evolutionary Aspects of Great White Shark Teeth by X-Ray Diffraction Methods and Other Supporting Techniques. Adv. X Ray Anal. 2004, 47, 327-337.

## PHOSPHOPROTEIN ENRICHED IN ASTROCYTES 15 (PEA-15) CHANGES CONFIRMATION UPON PHOSPHORYLATION & INTERACTION WITH FADD

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It's a race around the clock to find ways in treating cancer since it is the most leading cause of death worldwide according to the national cancer institute. Previous studies showed Phosphoprotein Enriched in Astrocytes (PEA-15) have a connection in promotor and suppressor tumor. This may be the critical point on how to treat cancer patient better from the unpleasant side effects from chemotherapy. It has been shown that only when PEA-15 is doubly phosphorylated at serine 104 and 116, mimicked by double mutant PEA-15DD ($S^{104}D/S^{116}D$), it interacts with FADD DED, causing the signal for cell death to be blocked, thereby mutated cell (tumor cells) will continue to grow and reproduce. Since there is little known in how PEA-15DD interact with FADD, the structure and dynamics of PEA-15 DD/FADD complex will be examine in this research. We expect that understanding of PEAD-15 DD interaction with FADD will inform how to break this interaction and to induce apoptosis within mutated cells. Bacterial strain BL21 (DE3) is used to express the following proteins: PEA-15, PEA-15DD, and FADD using lysogeny broth (LB) medium. The cells were then lysed and the proteins were purified. The purity of the proteins was confirmed by gel electrophoresis. NMR spectroscopy will be used to study the structure of the protein complex. Our initial results showed a conformational change in PEA-15DD comparing to the wild type. Future study will consist of finding the structure of PEA-15DD/FADD complex using NMR spectroscopy, differential scanning calorimetry and fluorometric assays.

## EFFECTS OF HAWAIIAN PLANT EXTRACTS ON METASTATIC PROSTATE CANCER CELLS

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Prostate cancer (PCa) is the second leading cause of cancer related death among men in the U.S. Although cancer survival rates have improved over the years, treatments for metastatic cancers are still limited. Cancer metastasis is the major cause of cancer morbidity and mortality, and accounts for about 90% of cancer deaths. In fact, the relative 5-year survival rate for advanced stage PCa is about 28% and there are no current treatments that can cure metastatic prostate cancer. In the present study, we evaluated the effects of novel compounds that have been extracted from Hawaiian plants on the viability of metastatic PCa cell lines. We tested the effect of PPE 28, PPE 28OAc, P2, BF1 1-1 BF1 1-2, BF1 1-3, BF1 1-7 and Red Algae Hexane on three metastatic PCa cell lines, MDA PCa 2b, E006AA-hT and PC3, using the 3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide (MTT) cell viability assay. Our current results suggest these compounds have varying efficacy in decreasing PCa cell viability. We observed about a 25% decrease in cell viability in E006AA-hT when treated with P2 and 35% decrease in MDA PCa 2b cell viability when treated with PPE 28OAc. These findings suggest that these novel plant extracts deserve further attention to investigate if they have a potential role in the therapy of metastatic PCa.

## SYNTHETIC STUDY & BIO-ACTIVITY TESTING OF ACTINOPOLYMORPHOL B

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Actinopolymorphol B was isolated from *Actinopolymorpha rutilus,* which was found in forest soil in the Yunnan Province of China. Chemical synthesis of actinopolymorphol B and its intermediates can provide significant amount of materials for biological activity study, first being a test for antibacterial activity. Several intermediates of actinopolymorphol B were synthesized in good yields by our laboratory. These synthetic intermediates were tested for growth inhibitory effects of bacterial strains: *Protcus mirabilis, Enterococcus faecalis, Bacillus cereus, Pseudomonas aeruginosa, Staphylvoccus epidermidis, Enterobacter aeroqenes, Kocuria rosea, Escherichia coli, Serratie marcescens, Proteus vulgaris* and *Mircococcus luteus.* The biological study testing will help to understand the structure and biological activity relationship for actinopolymorphol B and its intermediates.

## SYNTHETIC AND BIOCHEMICAL EXPLORATIONS OF THE TIANEPTINE SCAFFOLD

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Morphine and related opiate analgesics are among the most effective drugs for the treatment of severe pain. The analgesic action of these drugs is due to their ability to activate the mu-opioid receptor (MOR) in the spinal cord, brain stem, and forebrain pathways involved in transmission of painful stimuli from the peripheral sensory system into the Central Nervous System (CNS). Unfortunately, classical opioid analgesics suffer from serious disadvantages, namely high addiction liability, the rapid development of tolerance, and respiratory depression. Accordingly, novel opioid agonists with reduced potential for abuse remain of high interest. Therefore, small molecules activators of the mu-, delta-, and kappa-opioid receptors (MOR, DOR, and KOR) with low risk of abuse have high potential as therapeutic agents in treatment of pain and, as it has been reported lately, depression.

We are interested in exploring the molecular scaffold of a drug known as tianeptine, an atyptical tricyclic antidepressant that possesses unusual full agonist activity at MOR and DOR. This compound is particularly interesting because it seems to minimize the most common antidepressants' side effects: it seems to miminize the most common antidepressant side effects, as well as being fast-acting exhibits antidepressant effects even in patients who are resistant to treatment with other available drugs (~50% of patients), likely as a result of its opioid-mediated mechanism of action. At the same time, tianeptine's antidepressant actions are rapid and associated with fewer side effects compared to other pharmaceutical treatments for depression. However, tianeptine is marketed as a racemic mixture. It has been reported that one of tianeptine's enantiomers is more active than the other *in vivo,* but the absolute configuration of the stereocenter was not known. We have synthesized both enantiomers, tested them in biological assays measuring their functional activity at MOR/DOR/KOR, and determined the absolute configuration of each through a combination of spectroscopic and computational methods.

## EFFECTS OF NOVEL COMPOUNDS EXTRACTED FROM HAWAIIAN PLANTS ON PANCREATIC CANCER

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Pancreatic cancer (PC) has a very dismal prognosis. 71% of PC patients will die within the first year of diagnosis and only 8% survive more than five years. The prognosis is extremely poor and is due to the lack of an effective strategy for early detection of the disease. The average life expectancy after diagnosis with metastatic disease is just three to six months. The Ogunwobi lab is testing the effects of novel bio-active compounds, which may have anti-tumorigenic properties, on metastatic PC. A panel of 8 compounds were tested, all of which were soluble in dimethyl sulfoxide (DMSO). PPE 28A, PPE 28 OAC, P2, BF11-1, BF11-2, BF11-3, BF11-7 and red algae were tested. This study is aimed at investigating the effects and molecular mechanisms of action of these compounds on the PC cell line, PANC-1. Using this *in vitro* model, we performed dose-response experiments in order to determine at what concentration the compound reduces cell proliferation. We evaluated the effect of the compounds on cell viability with the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) cell viability assay. Our preliminary results suggest that these compounds may have different efficacy in decreasing cell viability. BF11-2 exhibited the most inhibitory effect with a 40-45% decrease in cell viability at 10µg/ml. We conclude that modifications to improve the potency of BF11-2 may make it a potential future therapy for use in the treatment of PC.

## PROTEIN PURIFICATION WITH USE OF SINGLE GST COLUMN

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KaiC, a protein necessary for the regulation of the circadian clock in cyanobacteria, was purified using only a single glutathione-S-transferase (GST) column. To successfully achieve a high purity of the protein by this method, the washing time was lengthened. The final eluted protein sample was found to be >95% pure, which is comparable to traditional KaiC purification methods of using both a GST and an anion exchange (Q) column. In this experiment, a high purity of KaiC is necessary to reconstitute the cyanobacterial circadian clock *in vitro*. Lower degrees of purity contain extraneous proteins, which can disrupt the circadian rhythm. These concepts ultimately illustrate the potency of using only a single GST column versus traditional methods. These findings impart convenience by streamlining existing purification procedures without compromising the quality of a protein sample.

## BIOCHEMICAL STUDIES OF BACTERIAL GROWTH AND PROTEIN EXPRESSION PATTERNS OF GUT MICROBES INCLUDING LACTOBACILLUS RHAMNOSUS GG AND ESCHERICHIA COLI K-12 USING UV-VIS SPECTROPHOTOMETRY, TWO DIMENSIONAL GEL

## ELECTROPHORESIS AND FAST PERFORMANCE LIQUID CHROMATOGRAPHY

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The long term goal of this project is to understand the symbiotic effect of the gut microbes and the current goal of the project is to qualitatively analyze the protein expression patterns of the two most common probiotic gut microbes, Lactobacillus rhamnosus GG and Escherichia coli K-12 strains, in different growth conditions including aerobic and anaerobic. The specific strains of the two target bacteria have been identified using common 16S rRNA sequencing. The growth studies of both bacteria were completed under aerobic and anaerobic conditions using UV-VIS spectrophotometry. For the UV-VIS spectrophotometry analysis, an OD600 measurement was used and the result clearly showed the differences in the growth phases of the two different bacteria under the same conditions (Tryptic soy broth media, 37°C and aerobic or anaerobic). Currently, analysis of the protein expression pattern in different air conditions for the bacterial strains studied is being conducted using the two different methods: a Fast Performance Liquid Chromatography (FPLC) and 2-D Gel Electrophoresis. In the future, the effect of symbiosis on protein expression among the common gut microbes will be studied.

## HORSE LIVER ALCOHOL DEHYDROGENASE EXPRESSION IN E.COLI

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Horse liver alcohol dehydrogenase (HLADH) is an interesting protein based on the properties of it's active site and the water expelled upon substrate binding. In order to analyze these characteristics, recombinant HLADH was expressed *E. coli* and purified to determine protein yield. Expression was induced in two systems, IPTG induction and autoinduction, to optimize for higher yields. Autoinduction was expected to be more effective for expression. Under the tac promoter, three autoinduction media were investigated, leading to insufficient results. Then, a plasmid constructed using the T7 promoter was also tested with the same media and promising results were obtained. Activity was characterized after purification.

## DIAMINE OXIDASE ENHANCED BY A GREEN PROCEDURE

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Diamine oxidase (DAO, E.C. 1.4.3.6) catalyzes the oxidative deamination of histamine (hence it is also known as histaminase) and other biogenic diamines. It is a homodimeric protein belonging to the class of copper-containing amine oxidases which catalyze the reaction of amines with dioxygen to form aldehydes,

ammonia and hydrogen peroxide. Beside copper they contain at the active site 2,4,5-trihydroxyphenylalanine quinone (topaquinone, TPQ).

Histamine is important for the functioning of many tissues because it is involved in neurotransmission, defense against bacteria and viruses, inflammation, and mediation in allergic reactions. Insufficient histamine and excess thereof are both harmful and have to be detected in a timely manner. Other biogenic amines synthesized and degraded during normal metabolic processes in animal, plants and microorganisms are putrescine, cadaverine, tryptamine, spermine, and spermidine. Their detection is important for medical applications but also in the food industry (for detecting spoilage in meat, fish, and fermented foods).

For such complex matrices, biosensors are the analytical tool of choice. A problem is DAO activity which is very low (typically reported /hour) due to the position of its active sites buried and accessible only from the enzyme surface, through a channel which varies in shape and depth, depending on the source of the enzyme.

The present study focused on "wiring" DAO, an oxidoreductase, with electroactive species ($Cu^{2+}$, pyridoxal phosphate). Copper ions are expected to enhance enzyme activity (DAO-friendly approach) and pyridoxal phosphate was chosen due to the similarity to topaquinone and to its price. Since electron transfer in proteins is a tunneling effect, "wiring" is expected to enhance the electron transfer rate of DAO and to facilitate access to the active sites.

A reagentless, environment-friendly procedure was used for "wiring" – exposure to high hydraulic pressure (325 MPa) for different times (30 min and 60 min, respectively), in parallel procedures, with and without modifiers present. After decompression, the modified enzymes (ME) were dialyzed and lyophilized. All ME retained activity (higher for shorter compression times) and were compared with the native DAO, and with the denatured/renatured DAO without modifier present. The activities were monitored over 90 days. The FTIR and the fluorescence spectra of ME showed noticeable shifts compared to the native DAO.

The potential of ME for use in biosensors for medical applications and for the food industry was investigated as well. A biosensor was built using the most active modified enzyme (DAO enhanced with Cu(II) ions, exposed to high pressure for 30 min) immobilized on a glassy carbon electrode (3 mm diameter), and using SCE as reference. It showed catalytic effect for putrescine and linearity as a function of putrescine concentration.

## CIRCADIAN CLOCK IN CYANOBACTERIA

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Earth's rotation about its axis occurs with a period of 24 hours. Life on Earth, in return, is able to predict and adapt to fluctuations in light intensity, temperature, and humidity. The circadian clock generates rhythmic patterns that control temporal programs of cellular physiology which are entrained by environmental stimuli. Many organisms display circadian clocks in their genome including human beings as is evident by our sleep wake cycle. The simplest circadian clock known is that of the cyan0bacteria *Synechococcus elongates*. The circadian clock can be divided into three components: the input, the oscillator, and the output pathway. The focus of this research is on the central oscillator that generates rhythmic patterns in cellular physiology and behavior. The oscillator can be reconstituted in vitro by three

proteins: KaiA, KaiB, and KaiC. The in vitro reaction begins as the purified proteins are reacted in a test tube with ATP. Rhythmic oscillations begin as KaiC is phosphorylated and dephosphorylated. During the first 12 hours, KaiA binds to the C-terminus residues of the A-loop on KaiC, promoting phosphorylation. This causes a conformational change of KaiC, which exposes the KaiB binding site. Once KaiB binds to KaiC, it inhibits KaiA promoting dephosphorylation. The A-loop of KaiC is critical to this oscillation process, since without it KaiA and KaiB cannot bind and thus KaiC cannot phosphorylate. Past studies have found that the A-loop is stabilized by a network of five hydrogen bonds. In theory, by breaking a hydrogen bond in the network, the A-loop will destabilize and cause change in the phosphorylation state of KaiC. The goal of this experiment was to make a mutation at the Arginine-488 (R488) residue of the A-loop, changing it to Alanine. Arginine contains a guanidino group, which contains nitrogen atoms capable of hydrogen bonding, whereas alanine possesses a methyl group, which cannot participate in hydrogen, thus causing a break in the network. It is expected that this mutation will not only destabilize the A-loop, but will change the phosphorylation pattern of KaiC, possibly even allowing phosphorylation without the presence of KaiA. Another such mutation is made to the A-loop of KaiC at site R488. A point mutation is performed at the site whereby the arginine is substituted by glutamine. This substitution mimics the KaiC residue sequence of the marine cyanobacterial genus *Prochlorococcus* which has displayed circadian oscillations without a significant portion of the KaiA genome. By inducing a point mutation, a *Prochlorococcus* like KaiC can be mimicked in the *Synechococcus* organism to reconstitute a two component circadian oscillator.

## SYNTHESIS OF POLYSTYRENE COATED WITH GOLD NANOPARTICLES FOR THE APPLICATIONS OF PLASTICS

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Gold nanoparticles (AuNPs) have found applications in fields such as genomics, clinical chemistry, laser phototherapy of cancer cells and tumors, targeted delivery of drugs, DNA and antigens, optical bio imaging and the monitoring of cells and tissues. [3] Various synthetic routes have been developed to control their sizes ranging from 1nm to 100 nm with moderate degrees of precision. They also possess an additional ability to be coated with polymers and other small molecules. [1]

This project focuses on the synthesis of silica coated gold nanoparticles and their incorporation into a polystyrene matrix. Polystyrene, a vinyl polymer $(C_8H_8)_n$ is used for the production of disposable plastics, detector housings, license plate frames, and other objects where a rigid, economical plastic. [1] Sonication has been used for catalyzing the chemical bond breaking and making since five six decades. In recent years, sonication has experienced a reinvigoration in the importance due to the top down synthetic strategies, which permit generation of nano-sized objects. [2] We are interested in exploring synthetic routes, which permit hybridization of organic and inorganic molecules via sonication protocols. In particular, we are interested in creating polymeric networks of silica with organic polymers such as polystyrene.

What is novel in this strategy is that despite the hydrophobicity of styrene, the reaction is carried out in water and ultra-sonication is used both a catalyst and emulsifier for our reactants. In this work, we will present our investigation of this new system where we have been able to create a new hybrid organic/inorganic network embedded with gold nanoparticles. The importance of this process is that we produce the heterogeneous fibers, which come out from these solutions during this synthetic process. One of the major advantages of this process is that it takes around 15-30 minutes to complete this hybridization

process. We will present our results of these studies and the detailed characterization of new products using NMR, TEM, SEM/EDS, FT-IR, and UV-Vis techniques. We will also will present preliminary investigations of mechanistic studies of this process.


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## HISTAMINASE DELIVERED BY NANOPARTICULATE CHITOSANS


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Histaminase (diamine oxidase, DAO, E.C. 1.4.3.6), catalyzes the oxidative deamination of histamine (hence it is also known as histaminase) and other biogenic diamines to form aldehydes, ammonia and hydrogen peroxide. It is a copper (II)-dependant, homodimeric protein which uses 2,4,5-trihydroxyphenylalanine quinone (topaquinone, TPQ) as coenzyme.

Due to the high occurrence of allergic reactions to the skin, to what is usually referred to as "histamine intolerance" (actually the effect of high histamine and/or high allergen concentrations), and to the common inflammatory processes affecting the skin, successful delivery of histaminase to the skin is very desirable. The problem is that the *stratum corneum* allows only small, lipophilic molecules to be absorbed through the skin and DAO is a big amphoteric molecule.

The present study focused on finding a vehicle for histaminase and investigating its potential for applications to the skin. Chitosan is a non-toxic, biodegradable, polycationic polysaccharide (2-amino-2-deoxy-β-D-glucan units linked through 1→4 glycosidic bonds). It is prepared from naturally available, inexpensive chitin. The abundant chitin yields chitosan through partial deacetylation and depolymerization. The interest in chitosan as delivery vehicle for active species resides in its biocompatibility, antimicrobial, and antifungal properties which are attractive when delivery to the skin is targeted. Nanochitosan, due to its size, is used in skin care for its own properties and also as vehicle for bioactive principles. It has high surface to volume ratio hence higher surface charge density and stronger biological activity than the starting material. Its mucoadhesivity was reported to enhance delivery of proteins while facilitating topical application.

The results presented herein are from a study of chitosan nanoparticles encapsulating histaminase from porcine kidney. Nanoparticulate chitosan was prepared by ionic gelation and crosslinking (using sodium tripolyphosphate). Starting materials were two different chitosans, one obtained from chitin by chemical processing and another obtained by a fermentation process. Similar conditions were used to obtain nanocomposites (chitosan-DAO) for which loading capacity and encapsulation efficiency were calculated. Two different ratios chitosan:DAO were used in parallel synthetic procedures. Nanochitosan obtained from

fermentation showed a lower loading capacity but higher encapsulation efficiency.

The nanoparticles were characterized by: ratio of residual amino groups (obtained by colloidal titration), FTIR spectroscopy, and scanning electron microscopy (SEM). The activity of the encapsulated DAO was assayed and compared to that of the starting enzyme.

The kinetics of protein release from nanoparticles was evaluated over eight days. Sigma nanochitosan afforded better kinetics and higher overall release of DAO compared to the fermentation chitosan. For both types of nanochitosan a higher protein to chitosan ratio resulted in enhanced kinetics and higher percent release of histaminase.

## CONVENTIONAL FMOC SOLID-PHASE SYNTHESIS, BIOCONJUGATION AND CHARACTERIZATION OF CANCER-TARGETING PEPTIDES

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Anti-cancer peptides and their bioconjugates have played pivotal roles in the progression of cancer detection and treatment methods. In spite of their potential, their lack of specificity to cancer cells leads to the many undesirable side effects. In an effort to overcome this limitation, cancer-targeting peptides (CTPs) have been developed and applied to the treatment of a wide range of cancers. They have not only served to improve detection and treatment of a wide range of cancers but have also served to address the issues related to specificity. In our research program, we have developed a wide range of CTP combinations in an effort to improve their anti-cancer and drug-like properties. For example, a cell-penetrating nucleolipid-peptide bioconjugate was found to exhibit cell apoptosis in a selected panel of non small cell lung carcinoma [1]. In our current study, we have explored conjugating the pro-apoptotic peptide with a cancer-targeting sequence for potential anti-cancer applications in tumors that overexpress the Glucose Regulated Protein of 78 kilodaltons on the cells surface [2]. The Glucose Regulated Protein of 78 kilodaltons (GRP78) is a chaperone protein which exists within all mammalian cells, however, it is uniquely presented on the surface of cancer cells where it signals tumor activity. In a related application, a small series of peptides were derived from the binding site epitope of B7-H6 [3]. B7-H6 is a tumor antigen for NKp30-dependent immunostimulatory activity of NK cells, which ultimately leads to the eradication of B7-H6 presenting tumor cells. In a related strategy, we've developed a series of peptides designed to target B7-H6 presenting tumors, leading to potential cancer-targeting applications. Lastly, the development of a new class of synthetically modified Peptide Nucleic Acids (PNAs) will provide entry points into cancer-targeting, gene delivery and gene silencing activities [4]. In sum, this presentation will highlight our most current research progress towards the solid-phase synthesis, characterization and anti-cancer applications of a selected panel of cancer-targeting peptides.

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# SILVER MEDIATED POLYRHODANINE POLYSILOXANE NANOCOMPOSITES

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Silver nanoparticle-polymer nanocomposites have extensive application as organic electroluminescent devices, antimicrobial surfaces, catalyst and electric devices. Conducting polymers like polyrhodanine, polyaniline, polythiophene, polypirrol behave as protectors against the attack of corrosive environment; and are used as chemical/gas sensors, photo-electrochemical cells, and light weight battery electrodes. PolyRhodanine (PRd) has immense antibacterial properties and a combination of interesting polymeric properties such as low density, flexibility and ease of modification. Metals like silver act as oxidants for the polymerization of Rhodanine to produces PRd nano fibers and silver ions are simultaneously reduced to silver nanoparticles. In this research, we are proposing coating of these nano fibers with functionalized polysiloxanes (Polymethylhydrosiloxane PMHS; 1,3,5,7 tetramethylcyclotetrasiloxane; Tris(3-trimethoxysilylpropyl)isocyanurate TTPI) to produce hybrid materials for grafting on the surfaces. It is expected that these AgNPs embedded in PRd-Polysiloxane hybrid composites will have practical applications in biomaterials, catalysis, and as conducting polymers with antibacterial properties.

# SYNTHESIS OF CO_GELS of POLYMETHYLHYDROSILOXANE AND POLYBUTADIENES AND THEIR THETHERING WITH ORGANIC FUNCTIONALITIES

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Hybrid materials possess physical and chemical properties, which is not available in either of the single constituents from which these materials are generated. Previous experimental research as shown that using Wilkinson's catalyst efficiently promotes coupling of polymeric Si-H bonds with alcohols and give well-defined designed silicones. [1] We have also demonstrated that one can generate multifunctional hybrid polysiloxanes in a one-pot process using achieved Pt-nanoclusters catalysis. [2]

In recent year's we have been exploring the synthesis and functionalization of hybrid gels, which are generated using siloxanes for controlling the resulting morphology and as well as the composition of the nanomaterials. In this publication, we will disclose our results of these investigations. This research focuses on the utilization of polymethylhydrosiloxane, known as PMHS for generation of hybrid polymers. The experimental route consisted of creating a hybrid polymeric network using PMHS and polybutadienes cross-linked in presence of a platinum complex (1, 5-cyclooctadiene)dimethylplatinum(II), as a catalyst. In this reaction, 2% of the platinum catalyst was suspended in a solution of benzene; which was used as solvent, and then to it added the dissolved cis-polybutadiene (cis-PBD) and solution of

polymethylhydrosiloxane (PMHS). This reaction provided functional gels where the ratios of PMHS and butadiene were varied. The detailed analysis of these materials was carried out using IR, NMR, X-ray, TEM, SEM and Edax techniques. To further probe the properties of these gels, alcoholysis functionalization of Si-H bonds of the gels was tested in the presence of isopropanol, benzyl alcohol, and other functional alcohols. FTIR was used a diagnostic tool to identify the precursor's gel peak of Cis-PBD, PMHS and the alcohols used in the functionalization reaction. Essentially our aim goal is to develop this process as a competitive alternative pathway from using Wilkinson's catalyst or Karstedt's catalyst as methods of functionalization of siloxanes.

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## MOLECULARLY IMPRINTED POLYMERS FROM ACETYLATED PEI

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Molecular recognition is vital to many biochemical processes and is at the heart of promising bio-medically related technologies. Molecular imprinting has proven to be a successful technique for generating synthetic molecular recognition, however, its utility has been limited since imprinted polymers are inherently insoluble. Our interest is in the design and development of water-soluble molecularly imprinted polymer biomimetic nanostructure for quadruplex DNA. Polyethyleneimine (PEI) is known to form polyplexes and has been widely used as a gene delivery vector. The high cationic charge density on PEI provides it with high affinity towards nucleic acids. Previous studies have indicated that these electrostatic interactions induce conformational change to quadruplex structures upon binding. To maintain template topology the charge density was reduced via the partial acetylation of PEI.

## GOLD NANOPARTICLE MEDIATED RUPTURE OF POLYMERSOMES USING ULTRAFAST SINGLE PULSE IRRADIATION

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The self-assembly of amphiphilic di-block copolymers into polymeric vesicles, commonly known as polymersomes, is an area of high interest in research due to the versatility of potential applications, namely, drug delivery and microreactors. These fully synthetic, robust vesicles are composed of a hydrophobic membrane and a hydrophilic core; this provides the ability for dual- encapsulation of a variety of molecules. Our studies seek to develop methods for triggered release using ultrafast, single-pulse irradiation with visible and near infrared light to provide a non-invasive method of achieving spatial and temporal control. We have shown that the incorporation of gold nanoparticles (AuNP) within the vesicle membrane or core provides wavelength specific vesicle rupture at 532 nm. The release profile can be tuned depending on the

laser fluence and location of the nanoparticles, and the release wavelength can be altered by changing nanoparticle characteristics. This project is unique as it is multidisciplinary, uniting chemical and physical sciences and ultimately has applications in biological studies.

## IMPACT OF MOLECULAR LENGTH AT OLIGOCARBAZOLE SINGLE MOLECULE WIRES

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St. John's University, Queens, NY

Scanning Tunneling Microscopy based Breaking Junction method (STM-BJ) developed in 2003 provides reliable, reproducible generation and measurement of electronic properties of molecular circuits. Encouraged by the great performance of polycarbazole material in electronic devices, we plan to synthesize three carbazole oligomers---monomer, dimer and trimer. Each molecule is terminated with two methyl sulfides as the gold atom linkers, with an eight carbon chain on nitrogen atoms. We will first investigate the impact of molecular length on electron transport through their backbones via STM-BJ technology. An exponential decay of conductance from monomer to trimer as the molecular length extends is expected. 5 grams of key intermediate 2,7-dibromo-9-octyl-9H-carbazole has been synthesized from commercially available 2,7-dibromo-9H-carbazole by a $S_N2$ reaction in high yield. With standard Lithium-Halogen Exchange and Suzuki Coupling protocols, we're synthesizing these three carbazole oligomers.

## SYNTHESIS OF A, A, -DIBROMOKETONE CATALYZED BY ORGANOSILANES FROM ALKYNES

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Bis (3- (trimethoxysilyl)propyl) amine is an organosilane and is typically used as an silsesquioxane precursor to synthesize organosilica materials. 2-Ast (N-(2-aminoethyl)-3-aminosilanetriol) is an organofunctional silane polymer post hydrolysis that is very stable in aqueous solutions due to internal hydrogen bonding. Organosilanes have a history of employment in a variety of chemical entities, most commonly used as protecting groups in organic synthesis. The unique feature of silanes are the ability to act as a moisture scavenger, alkoxy groups on silanes will hydrolyze and cross link in water. In our laboratory, we are interested in alkyne difunctionalization using environmentally friendly reagents. Our previous work included $Au^{III}$ catalyzed synthesis of α-halomethyl ketones and $FeCl_3$ catalyzed synthesis of α,α,-dibromoketone from alkynes. Hydrolysis of Bis (3- (trimethoxysilyl)propyl) amine forms an interconnected gel matrix and was found to be a recyclable catalyst for halo-functionalization of terminal and internal alkynes into α, α, -dibromoketone in high yields. 2-Ast (N-(2-aminoethyl)-3-aminosilanetriol) was also found to be a catalyst for halo-functionalization for terminal and internal alkynes. This synthesis features desirable functional group compatibility and high regioselectivity in a one pot reaction. Further investigation of the substrate scope of the organosilane, Bis (3- (trimethoxysilyl)propyl) amine and (N-(2-aminoethyl)-3-aminosilanetriol) is in process in our laboratory.

## SYNTHESIS, PURIFICATION AND CHARACTERIZATION OF ASYMMETRIC FLUORINATED PHTHALOCYANINES

***Ralph Foglia III*****, Olivia Xiao, Pelmus, M.,** and Dr. Sergiu Gorun
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Synthesis and purification of asymmetric phthalocyanines of the type $A_xB_y$, where A and B are phthalodinitrile precursors and $x + y = 4$ is a challenge since products may include combinations with $4 \geq x, y \geq 0$. We report here the microwave assisted synthesis and purification of asymmetric fluorinated phthalocyanines for which two different precursors, A = perfluoro-(4,5-diisopropyl)phthalonitrile, and B = perfluoro-(4-dimethylamino)phthalonitrile, were used in order to obtain a functional, $A_3B$ amino macrocycle. Different reaction conditions were screened in order to increase the yield and a fast chromatographic separation method based on mobile-phase pH variation was discovered. UV-Vis, FTIR and NMR confirmed the identity of the $A_3B$ product and $A_4$ by-product.

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## RADICAL OXIDATIVE COUPLING REACTION OF ALCOHOLS AND ALKYNES

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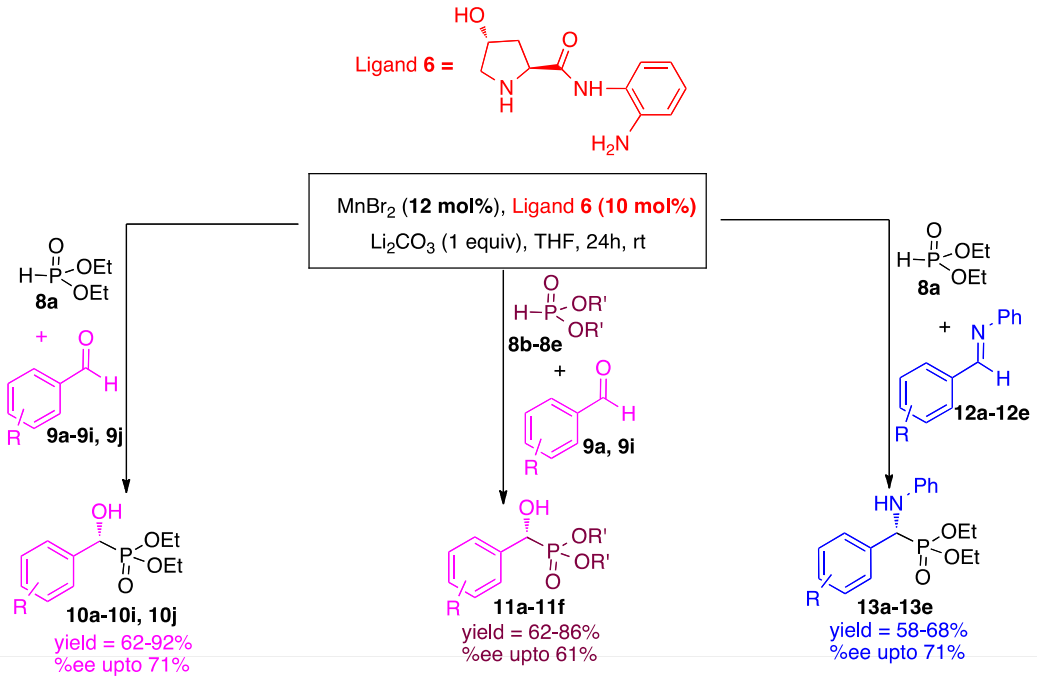
Alcohols are abundant and commonly used organic building blocks in large-scale chemical synthesis. Our lab has developed various transition-metal-catalyzed alkyne difunctionalization reactions. This work aims to develop the radical oxidative coupling of un-activated alcohols to alkynes to simultaneously generate regioselective C=O and C-C bonds. The reaction will employ molecular dioxygen, an environmentally benign and abundant resource, as the external oxidant. Currently, the optimal conditions are being sought by employing different radical initiators, transition metal catalysts, and thermal conditions. Successful coupling of alkynes to alcohols using radical oxidative coupling will provide a low-cost and efficient method for producing complex structures for use in organic synthesis.

## MANGANESE-PROLINE DERIVED NEW CATALYST SYSTEM FOR THE ENANTIOSELECTIVE SYNTHESIS OF α-HYDROXY PHOSPHONATES/α-AMINO PHOSPHONATES

***Hyun Lim*** [#]***, Prianka Chohan, Muttalib Khan,*** **Vicklyn Datilus** [#]**, Rania Teriak,**
and Dr. Parminder Kaur [*]
Department of Chemistry
William Paterson University, Wayne, NJ

A novel manganese/proline-derived catalyst system is reported for the stereoselective synthesis of $\alpha$-hydroxyphosphonates and $\alpha$-aminophosphonates. The reaction proceeded smoothly under mild reaction conditions with efficient reaction times. The resulting products were obtained with high yields and good enantioselectivities (up to 83% ee).




# SEQUENTIAL EXPERIMENTS TO SYNTHESIZE DIPHENYLACETYLENE FROM STYRENE IN THE UNDERGRADUATE LABORATORY

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A set of experiments were developed to convert styrene into diphenylacetylene. In the initial experiment, styrene was reacted with the Hoveyda-Grubbs catalyst in solventless olefin metathesis reaction to produce stilbene. This reaction was successfully run in the 100+ student undergraduate organic laboratory course. With the intention to make this a three-week sequence two subsequent experiments are being tested. The second experiment, the stilbene was reacted with pyridinium tribromide in acetic acid to produce meso-1,2-dibromo-1,2-diphenylethane. In the final experiment, meso-1,2-dibromo-1,2-diphenylethane was reacted with KOH in 2-propanol to produce diphenylacetylene. The reaction yields of each experiment were 90%, 62% and 45% respectively. Optimization of the second and third reactions are currently underway. This sequential process can be used in an undergraduate organic laboratory where the students can do these experiments in tandem to learn about different organic reactions, reaction

mechanisms, and the design of a multi-step synthesis. The experiments were designed to minimize the chemical waste and follow some of the Principles of Green Chemistry.

## A NOVEL NITROGEN-NITROGEN BOND FORMATION: SYNTHESIS OF [2H]-INDAZOLES

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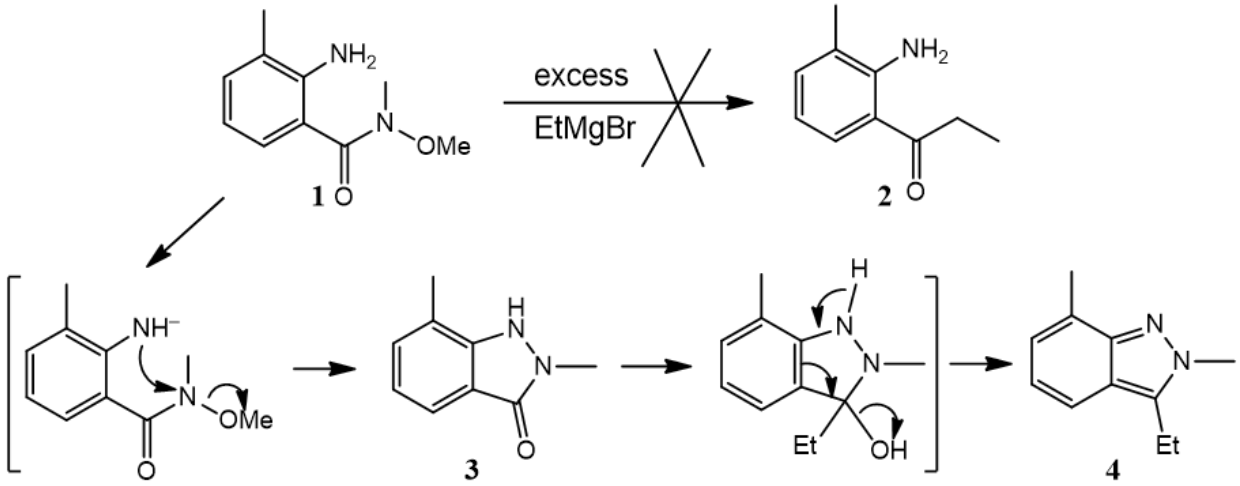
Since their original description by Nahm and Weinreb, N-methoxy-N-Methyl amides have been widely used as intermediates to allow the conversion of carboxylic acid derivatives into ketones and aldehydes via the addition of organometallic reagents. We attempted to use this chemistry with Weinreb anthranilamide (**1**) derivatives and an excess of ethyl magnesium bromide to produce o-ethlylketoneaniline (**2**). The cleanly obtained product was not, however, the targeted ketone. Instead, it was a material whose $^{1}H$ and $^{13}C$ NMR and mass spectrum corresponded to the 2-methyl-3-ethyl-[2H]-indazole (**4)**. Our proposed mechanism involves an intramolecular direct displacement of the N-methoxy group of the Weinreb amide to produce the indazolinone intermediate (**3**). Nucleophilic attack on the carbonyl and elimination of water then provides the observed indazole. The preliminary success with ethyl magnesium bromide has since been replicated with isopropyl, phenyl, and methyl magnesium bromide. This poster describes our efforts to optimize and determine the scope and limitations of the overall conversion of Weinreb anthranilimides to [2H]-indazoles. It also outlines our investigation into the proposed mechanism, by utilizing non-nucleophilic bases to confirm the intermediacy of indazolinones. Possibilities for the enhancement of the proposed unusual nitrogen-nitrogen bond formation through direct substitution are also discussed.



# TITANIUM-PROLINE DERIVED SYSTEM FOR THE ASYMMETRIC SYNTHESIS OF PROPARGYL ALCOHOLS

***Chelsea Sweet*, *Dina Moustafa*, *Laura Perdomo-Quintero*** and Parminder Kaur
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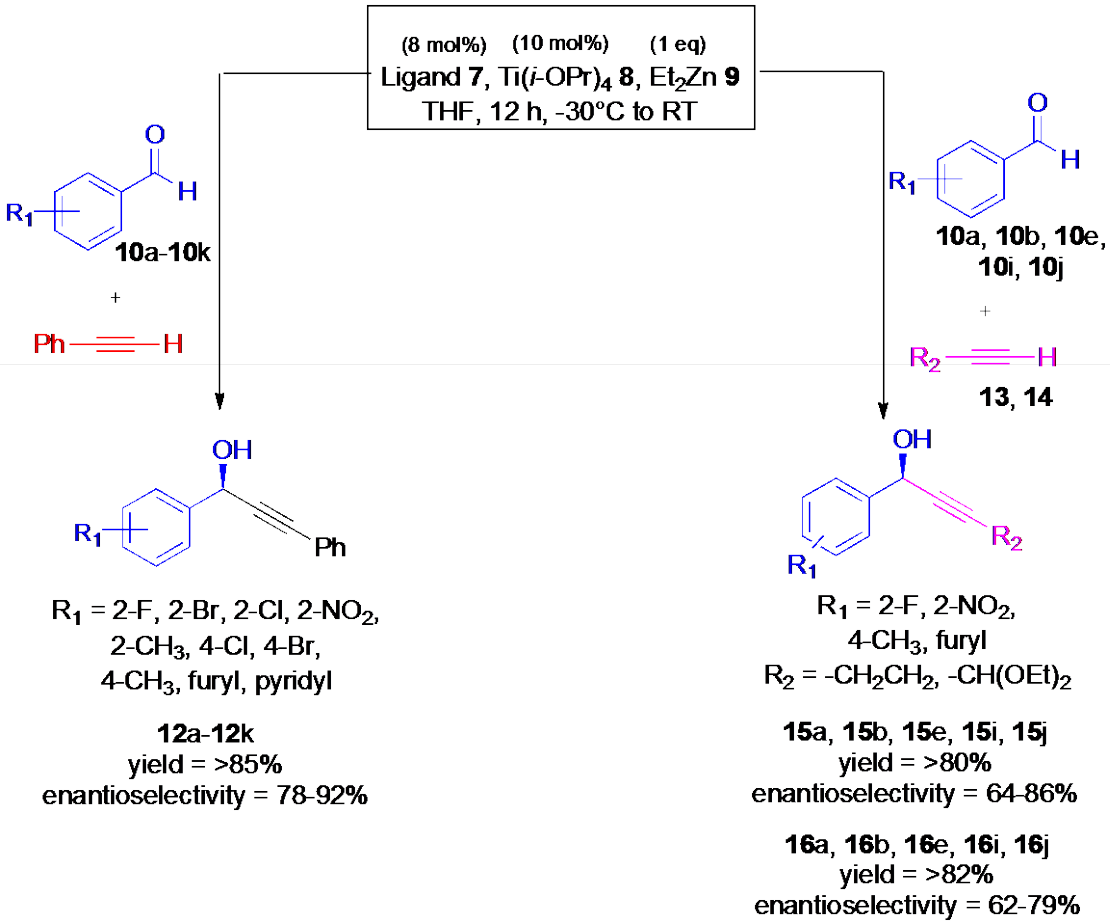
A novel titanium/proline-derived catalyst system is reported for the enantioselective synthesis of *propargyl alcohols*. The reaction proceeded smoothly under mild conditions with efficient reaction times. Initially, lithium acetylide was employed to carry out the nucleophilic addition reaction, however poor reaction profile was achieved with poor enantioselectivities. When diethylzinc was used instead, high product yields (>85%) and moderate to high enanitoselectivities were achieved (68-85%). Three different alkynes were used to carry out the reaction with a series of different aromatic and heterocyclic aldehydes. Better reaction profiles were achieved with aromatic alkynes than with aliphatic ones.



## CARBOXYLIC ACID FUNCTIONALIZED CATIONIC PORPHYRINS

***Rebecca L. Wodzinski*, Isma'il Kadam, Jesse Hackett**, Dr. Mohammed R. Elshaer
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Attempts at binding distinct DNA loci through sequence specific recognition has demonstrated limited success. Higher-order DNA structures known to participate in regulatory roles, including quadruplexes, have emerged as attractive druggable targets possessing distinguishable architectures. Thus, ligand design has shifted focus from sequence specificity to structure specificity. Porphyrin macrocycles are well known quadruplex binders with similar dimensions to that of quadruplex G-quartets allowing for π-stacking interactions. Additionally, cationically charged porphyrins introduce electrostatic interactions with polyanionic DNA and provide water solubility. With the aim of preparing structure specific quadruplex ligands, we have incorporated cationic porphyrins bearing carboxyl functionality for subsequent attachment of appendages that provide greater affinity and groove binding interactions.

## Synthesis of Heterocyclic Indolizines and its Application in Antibacterial Activity Studies

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Previously, our lab developed a reaction generating -halomethyl Ketones from terminal alkynes catalyzed by Au (III) catalyst in the presence of NXS. The -halomethyl Ketones are used as intermediates in synthesizing heterocyclic compounds called Indolizines. Indolizines are important biological compounds due to their antibacterial, antifungal, antiviral and antitumor activities . This one-pot synthesis of Indolizines is transition-metal free, utilizing an electron-deficient alkene and TEMPO as an oxidant . We present antibacterial activity of our Indolizine analogs on gram negative and positive bacteria, which included Escherichia. coli, Staphylococcus epidermis, Sarcina marcescens, Micrococcus luteus, Bacillus cereus, Pseudomonas aeruginosa and Proteus vulgaris. A spread plate method was used to determine antibacterial activity with agar growth nutrient medium. Formalin (1%) was the established positive control and DMSO was the negative control. Preliminary results showed some inhibition of selected bacteria, using 50 L from 2 mg/mL stock solution of. Further investigation is currently being conducted to establish proper antibacterial activity of our Indolizine compounds.

## CITRUS FT-LIKE GENOMIC TRANSGENES: BIOINFORMATICS AND FLORAL INDUCTION PHENOTYPES IN A MODEL PLANT

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Genetic improvement by conventional breeding techniques is hampered in some citrus species such as *Citrus sinensis* (Sweet Orange) that require 8-10 years to transition from the juvenile to reproductive growth

phase. *Flowering locus T (FT)* genes in all examined flowering species have been shown to express a long distance signaling protein that is key for floral induction. Ectopic expression of cloned *FT* genes reduces the juvenility period, promoting precocious flowering in model systems. Previously, three *FT-like* genes; *ciFT1, ciFT2* and *ciFT3,* have been described in citrus. Genomic sequences from three citrus genes were cloned into the pCAMBIA 2201 vector and stably integrated into tobacco, *Nicotiana tabacum* L. cv. Samsun by *Agrobacterium tumefaciens* mediated methods. Plants transformed with the *ciFT1* and *ciFT3* clones demonstrated precocious flowering as determined by developmental comparisons against sibling plants that did not carry a transgene. Plants carrying the *ciFT2* clone did not significantly alter flowering time as compared to the controls. CLUSTALW alignment of the translated amino acid sequences shows the citrus *ciFT1* and *ciFT3* differ from *ciFT2* at an arginine residue that is conserved in many, but not all *FT* genes. Finally, bioinformatic work has identified a fourth *FT-like* sequence, and placed all four sequences on chromosome six of *C. sinensis*.

## DETERMINATION OF THE EBOLA VIRUS 5′-UTR SECONDARY STRUCTURE

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Ebola is a single stranded RNA virus that has affected about 28,000 people since last year, mostly in the North West African countries. The outbreaks in Africa are getting under control but without a current vaccine or an established method of treatment for Ebola, it is only a matter of time until the next one.

Like any other RNA strand of genetic material, Ebola's RNA genome consists of coding regions and non-coding regions. The coding regions encode for the proteins of the virus, both structural and non-structural (such as enzymes). The non-coding regions on the virus, which are located at the 5′- and 3′-ends of the RNA, are responsible for the maintenance and replication regulation of the virus. These untranslated regions (UTR) fold into a secondary structure independently from the coding regions of the RNA strand.

The goal of this project is determining the secondary structures of the UTR at the 5′-end. Ebola's UTRs has specific secondary structure features such as base-paired stems and single-stranded regions. To determine the secondary structure of RNA, the selective 2′-hydroxyl acylation analyzed by primer extension (SHAPE) experiment has been shown to be effective. This experiment works by partially acylating the single stranded areas of the RNA while it is in its secondary structure. Next, reverse transcription is done which stops at the points where acylation has occurred. The varying lengths of DNA created are used to determine where the stem and loop structures are.

A consensus sequence of the first 80 nucleotides was determined out of 160 Ebola sequenced genomes. DNA oligonucleotides were purchased and amplified through PCR and transcribed. The RNA includes an extra sequence where a fluorescent primer can bind for reverse transcription initiation.

The next step is to perform the SHAPE experiment on the RNA to determine the secondary structure of the 5′-UTR. The following step of the project will be to perform this process on a different strand of Ebola and compare the structures. Moreover, incubation of the RNA with cell extracts before the SHAPE experiment may be envisaged to monitor potential protein binding to the Ebola 5′-UTR.

## SYSTEMATIC CHARACTERIZATION OF THE REGULATORY ROLE OF

## ADJACENT GENE CO-REGULATION IN THE BUDDING YEAST RIBOSOMAL PROTEIN REGULON

***Reem Eldabagh*** and Dr. James T. Arnone
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Gene therapy may be a cure for progeria, cancer, and aging. Before transplanting genes into one's genome, the effects of spatial positioning on gene regulation must be thoroughly understood. The genomic arrangement of the ribosomal protein (RP) regulon is widely conserved across many eukaryotic species. The eukaryotic ribosome is highly conserved in the budding yeast, *Saccharomyces cerevisiae*, making it a great model for study. The RP genes that are found as adjacent pairs were identified and their promoters were mapped using a bioinformatics program (YetFaSCo) to identify the binding sites of the known transcription factors (TF). A two-step process (the '*delitto perfetto*' method) was designed to selectively mutate these *cis*- regulatory sequences for each of the 12 RP pairs through homologous recombination. PCR primers were then designed for the application of the '*delitto perfetto'* method to create mutant yeast strains – whereby the promoters of each RP gene would have scrambled TF binding sites. By selectively mutating each promoter, the effect on the transcriptional regulation of each gene pair can be studied. After transformation mutant strains were verified phenotypically (through replica plating) and genotypically (by diagnostic PCR). Follow up work will involve measuring gene expression in the mutant strains by reverse-transcription and real-time PCR, and comparing each mutant to the corresponding wild-type strain. This will allow us to test the extent of adjacent gene co-regulation in the ribosomal protein regulon. Meta-analyses considering the gene pair as well as 6 neighboring genes on either side were performed using transcriptome data under different stress conditions. By conducting such analyses on genomic neighborhoods, we may investigate promoter sharing as an underlying mechanism of adjacent gene co-regulation.

## INVESTIGATING INTO THE ROLE OF SPATIAL POSITIONING AND ADJACENT GENE CO-REGULATION IN THE COORDINATION OF THE HEAT SHOCK PROTEINS GENE EXPRESSION IN, *SACCHAROMYCER CEREVISIAE*

***Maria Katrina Holganza*** and Dr. James T. Arnone
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The transcriptional regulation of genes is vital to all organisms, playing a critical role in processes such as cell cycle progression and control, cellular differentiation, and development. Understanding the transcriptional regulation of genes can yield insight in higher eukaryotes, such as: the enhancement of cellular tolerance to ischemic injury, potential protection against stress agents in the cardiovascular system in humans, and resistance to heat stresses in plants (X et al., 1992; Snoeckx et al., 2001; Vincour and Altman, 2005). Certain sets of co-regulated genes, like those that encode for heat shock proteins (HSPs), are only activated under stressful conditions. It is a challenge to coordinate the regulation of functional sets (regulons) of genes, such as the members of the heat shock gene family. One potential regulatory mechanism that these genes undergo is via genomic position - which can lead to adjacent gene co-regulation, as seen in the genes of the ribosomal biogenesis regulon. The objective of this research is to explore the conservation of both 'adjacent gene co-regulation' and the 'promoter sharing' hypothesis as a

regulatory mechanism for the HSPs, using the budding yeast, *Saccharomyces cerevisiae* as a model system. My project is focused initially on the gene pairs *SGT2- SLG1* and *MDJ1-HSP12*. First the genomic neighborhood was identified and gene expression data was extracted from the Gene Expression Omnibus to characterize the transcription within each region. Transcription factors were identified and their binding sites were mapped within the 600 base pair promoter, using YETFASCO (Boer and Hughes, 2011). PCR primers were designed to insert a mutagenic construct, utilizing the '*delitto perfetto*' method. Our strategy is two-fold – In part one we will integrate a counter selectable construct and monitor the effect on the transcription of the entire neighborhood in response (to test the 'promoter sharing' hypothesis). In part two we will perform a secondary transformation to knock out the construct while mutating the corresponding promoter motifs for the gene pairs and monitor the effect on the transcription of the pair in response (to test the 'adjacent gene coregulation' hypothesis).

## EXAMINING THE ROLE OF FASCIN IN PRIMARY BRAIN CANCERS

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As one of the main actin bundling proteins found in the body, Fascin plays an important role in maintaining many regulatory behaviors. It is vital for proper cell-cell adhesion through cytoskeletal structures and has been shown to play a role in a cell's motile and invasive properties. In particular, Fascin is an important protein to study because its overexpression is seen in various cancers. Previous literature has shown that upregulation of Fascin increased the metastatic and invasive properties of colorectal cancer cell lines. Additionally, Fascin has been previously identified in a set of genes that mediated breast cancer metastasis to the lungs and has been implicated in gallbladder, pancreatic, and prostate cancer as well. Primary brain cancers, which can be very aggressive, also seem to have elevated fascin levels that correlate with tumor grade. In this project we examine the role of Fascin in neural cancers like neuroblastoma and glioblastoma. We characterized Fascin gene expression in brain cancer cell lines using RT-qPCR to assess mRNA levels, and immunocytochemistry to determine relative protein abundance. Preliminary results show robust Fascin mRNA expression in Neuro2a neuroblastoma and A-172 glioblastoma cells. Furthermore, immunostaining of both total Fascin and phosphorylated Fascin was elevated in mouse Neuro2a neuroblastoma cells when compared to Human Embryonic Kidney cells (HEK-293), which have reportedly low Fascin expression levels. A-172 cells also exhibit distinct Fascin immunostaining.

Following analysis of Fascin expression in additional brain cancer cell lines, we will evaluate whether overexpression of Fascin increases motile properties of neuroblastoma and glioma cells in culture using a scratch invasion assay technique.

## THE CELL TYPE SPECIFIC EFFECTS OF RNA BINDING PROTEIN HUD ON NEOCORTICAL PROJECTION NEURON IDENTITY

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Proper spatiotemporal development is important for the creation of the highly organized six layered

neocortex and for the proper neuronal subtype specification within each layer. The improper formation of the neocortex during neurodevelopment has the potential to contribute to a variety of disorders such as autism, schizophrenia, and epilepsy. Thus, an understanding of the novel mechanisms of neurodevelopment is crucial finding early interventions for these diseases. While this process has been extensively characterized on the transcriptional level, the role of post-transcriptional processing at the cell type specific level is still poorly understood. RNA binding proteins (RBPs) control every step of this process. Using *in utero* electroporation and immunostaining for cell type specific markers expressed in the developing neocortex, our results show that distinct isoforms of RBP, Human antigen D (HuD), regulate neocortical development on a post-transcriptional and cell type specific level by promoting the creation of distinct neuronal subtypes. Particularly, distinct isoforms HuDiso3 and HuDiso4 are shown to have varying effects on neuronal subtype specification. For instance, HuDiso3 appears to promote the development of lower layer neurons when expressed at the stem cell level while HuDiso4 appears to promote the development of upper layer neurons when expressed in post-mitotic neurons. Thus, this study has revealed a novel mechanism for the post-transcriptional control of neocortical development. Understanding the cell-type specific effects of the different HuD isoforms will bring us one step closer to understanding neurogenesis while also revealing a potential therapeutic target for preventing neurodevelopment disorders.

## A NOVEL STUDY OF THE AGCCRE "KNOCKOUT" TRANSGENIC MOUSE MODEL

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Osteoarthritis (OA), also known as degenerative joint disease, is the most common form of arthritis affecting over 26 million people in the US. It is characterized by the degradation of articular cartilage leading to joint dysfunction usually in the hips, hands, knees and spine. Sufferers often experience symptoms of pain, stiffness, tenderness, inflammation, loss of flexibility and growth of bone spurs – bony outgrowths that form around the affected area. Currently, there is no effective treatment for OA. Because this disease results mainly from the loss of cartilage, a slippery cushion between the joints, it is crucial to obtain a better understanding of the genetic mechanisms which control the normative growth and maintenance of synovial joint cartilage. Up to date, little progress has been made in this area of research. The main goal of our research is to identify and verify an effective genetic tool to study gene function in joint cartilage and joint development to provide valuable information in the discovering of genetic causes of OA. This effective genetic tool may also lead to discovery of novel treatment for this disease.

In this study, we reported the adaptation of a novel inducible cartilage cell-specific transgenic mouse model to study the genetic causes of OA, *AggrecanCreERT2 (AgcCre).* TdTomato fluorescent reporter transgenic mouse line was used to verify the cellular specificity and validate the efficiency of *AgcCre ERT2* for the study of gene function in joint cartilage at various stages. In the next stage of research, the Cre-loxp system will be used to knockout *Has2 ,* a major synthase cartilage matrix carbohydrate molecule hyaluronic acid, to study its genetic roles for synovial joint formation and for the genetic causes of OA. Hyaluronic acid production has been essential for the normal formation and healthy cartilage maintenance of synovial joints. This would be the first possible approach to study the genetic role of *Has2* and any candidate genes specifically on joint cartilage cells. It would contribute and fill in the gap for the molecular mechanism of joint cartilage specification and shed light on the discovery of genetic causes of OA.

## CLONING OF A FLUORESCENT REPORTER GENE AS AN ASSAY FOR RIBOSWITCH MODULATION

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This project has been attempted by a previous student where the sequencing returned with missing genetic information. Therefore, I restarted the project with the same goal of creating a biosensor system using the pHL 1278 plasmid for the theophylline aptamer. Theophylline is a molecule that is similar to but differs from caffeine by only one methyl group. It is used in inhalers as a bronchodilator for those who suffer from asthma. An aptamer is RNA that binds to a specific molecule in this case the aptamer we are focusing on is the one for theophylline and the project will also further prove the concept of the theophylline aptamer. In order to test this theory, an expression platform, riboswitch, needs to be created to pair with the aptamer. This riboswitch is a section of the DNA that will have the gene expression paired and a specific aptamer with which it binds, the theophylline aptamer.

A riboswitch that is known to bind to theophylline was inserted into the pHL plasmid that was isolated through a series of purifications and replications. The insert was isolated with two enzymes and the plasmid was as well, using the same two enzymes. In theory, once cloning has taken place, the final plasmid structure will consist of a single promoter, the mCherry gene, the riboswitch, and the GFP gene. In this gene expression system, mCherry will always be translated as the protein. GFP translation will be regulated by the presence of theophylline. In the absence of theophylline, the sequence of DNA necessary to translate GFP is inaccessible and will prevent the translating of GFP. Therefore, to test for the success of the ligated plasmid and the effectiveness of the riboswitch as a biosensor, a ratio of the mCherry vs. GFP will be used.

## CATALASE FROM BEEF LIVER USED AS STRONG ANTIOXIDANT AGENT AND IN BIOSENSING

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Catalase is an enzyme found in most organisms exposed to oxygen. Catalase is a tetramer, each unit containing over 500 amino acids and a heme (containing iron), as prosthetic group. It is a very important enzyme in reproductive reactions and a very strong antioxidant.

Antioxidants are compounds that help protect cells from free radicals-induced cell damage. Several enzymes can act as biocatalysts in reactions leading to removal of reactive oxygen species. Catalase is a potent endogenous antioxidant enzyme which acts by converting toxic hydrogen peroxide to harmless water and oxygen (with one of the highest turnover numbers known), thereby inhibiting oxidative stress. Catalase is believed to reverse the process of ageing and it can be used as an additive in pharmaceutical and cosmetic formulations for the skin.

A problem with catalase is its inactivation at high, toxic, non-physiological levels of peroxide. The result is difficulty in studying this enzyme, low sensitivity of assays and/or enzyme inactivation.

The present study targets stabilization and enhancement of catalase from beef liver (E.C. 1.11.1.6) by a

reagentless, green procedure. High hydraulic pressure (325 MPa) was used to unfold the enzyme in the presence of iron (II) sulfate heptahydrate and lipoic acid (known antioxidant), respectively. Upon removal of high pressure, modifier molecules were entrapped in the renatured structure of catalase.

The modified enzymes (ME) were dialyzed, lyophilized, and subsequently characterized. All ME retained activity. Residual activity was higher for shorter compression times. The modified 3-D structures showed noticeable shifts in the FTIR and the fluorescence spectra. Presence of additional Fe(II) ions was beneficial for catalase activity while the presence of lipoic acid within the renatured structure afforded a higher antioxidant effect compared to the native enzyme. Following modification, all MEs retained activity for 90 days.

The catalase modified with iron (II) sulfate heptahydrate was tested in a biosensor for hydrogen peroxide detection. The "wiring" procedure resulted in a self-mediated enzyme, which displayed catalytic effect and linearity in peroxide concentration.

## THE EFFECT OF DETERGENT ON THE INHIBITION OF MATRIX METALLO PROTEINASE (MMP) 1

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MMPs are found abundantly throughout the body and play important roles including breaking down of damaged and worn out structural proteins. MMP-1 inhibition has been associated with various diseases like cancer, ageing etc. High-throughput screening (HTS) is the major technique by which active site specific molecular inhibitors are discovered. However, one of the disadvantages of this technique is the inhibition by false-positive ligands caused by the formation of colloidal aggregates through the self-association of organic molecules in aqueous solutions. Many hydrophobic small molecules may self-associate into colloidal aggregates at micro-molar concentrations that may inhibit enzymes nonspecifically. These aggregates typically form at micromolar concentrations and are often several hundred nanometers in diameter. Our lab has reported earlier MMP 1 inhibitors using computational screening followed by enzyme kinetics study. Those experiments were done under micromolar to milli molar concentrations. Here we report reexamination of those inhibitors against MMP 1 in the presence of detergent to rule out any aggregate formation. Our results indicate there was hardly any inhibition by the aggregates of the inhibitors in our case.

## TOLERANCE LIMITS OF CELLS TO NICOTINE EXPOSURE

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Tolerance Limits of Cells to Nicotine Exposure at Concentrations Used in E-cigarette Solutions Previous studies of lung epithelial cell cultures indicate a cytotoxic effect of 1.8 mg nicotine per ml 50/50 propylene glycol (PG) and vegetable glycerin (VG), simulating a low dose of e- cigarette vapor solution without

flavoring chemicals. Current research, using yeast as a model, determined whether a strong concentration of nicotine solution (a dose used by heavy smokers) might generally cause death or prevent regeneration of eukaryotic cells. The results of the experiment indicated that the growth of yeast at densities similar to epithelial cells was not inhibited by the solution containing nicotine concentration levels as high as 24 mg/ml of 50/50 PG+VG after 24 hours of continual exposure. The follow-up research efforts are currently focusing on testing the toxicity limits of nicotine solutions supplemented with flavoring additives commonly used by smokers such as diacetyl 2,3 pentanedione.

## SEASONAL VARIATION IN ACTIVITY METABOLISM OF THE RUBBER BOA (*CHARINA BOTTAE*)

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As part of ongoing work examining seasonal changes in locomotor performance in Rubber Boas (*Charina bottae*), we measured metabolic rate during physical activity of six individuals during the late active season and during artificial hibernation using a paired design. Specifically, we quantified rates of $O_2$ consumption and $CO_2$ production during forced activity using an open-flow respirometry system. After adjustment for variation in snake body mass, we found that both $O_2$ consumption and $CO_2$ production rates during activity were significantly lower during artificial hibernation. Mean respiratory exchange ratio did not differ between seasons, suggesting similar patterns of substrate use to fuel physical activity in each season. Future studies will compare the thermal sensitivity of crawling speed and righting time between seasons to determine if seasonal differences in aerobic capacity also result in seasonal differences in locomotor performance.

## REGULATION OF CAMKII AT INHIBITORY SYNAPSES BY CALDINEURIN

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Ca2+/calmodulin-dependent protein kinase II (CaMKII) is known for its critical role in learning and memory. Activated CaMKII increases the strength of excitatory synapses, which is thought to be how memories are stored. CaMKII also regulates inhibitory synapses under different stimulus conditions. The question remains of how CaMKII can be differentially regulated at inhibitory versus excitatory synapses. One possible explaination is that autophosphorylation of CaMKII may affect its movement to inhibitory synapses. Calcineurin is a protein phosphatase, which dephosphorylates many CaMKII targets, and may affect CaMKII phosphorylation as well. This investigation tested the hypothesis that dephosphorylation by calcineurin may regulate CaMKII trafficking. The activity of Calcineurin was blocked using the inhibitor, cyclosporine A (CSA), and CaMKII localization at inhibitory synapses was examined by immunocytochemistry. Results suggest that baseline activity in cortical neurons causes localization of CaMKII at inhibitory synapses, which was reduced by blocking CaMKII activation with CSA. In the

presence of CSA alone, there was modest increase in colocalization of CaMKIIα at inhibitory synapses. With NMDA treatment CaMKII colocalization increased at inhibitory synapses which was enhanced even further when calcineurin was inhibited. Overall, results support the possibility that calcineurin activity may reduce the localization of CaMKII at inhibitory synapses.

## LIFE AND DEATH PARTNERS: OXIDATIVE STRESS AND AUTOPHAGY DURING SKIN MORPHOGENESIS IN TADPOLES *XENOPUS LAEVIS*

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Anuran skin undergoes several changes during metamorphosis to adapt an amphibious mode of life. Cell death of larval organs and tissues occur in balance with proliferation of larva to adult cells and apoptosis of larval cells. Apoptosis is widely accepted as the major cell death during amphibian metamorphosis and partly it is mediated through oxidative stress – an imbalance between reactive oxygen species (ROS) and antioxidant defenses. The antioxidant enzymes Superoxide dismutase (SOD) and Catalase are responsible for removal of free radicals such as superoxide ($O^{-}_{2}$) and hydrogen peroxide ($H_2O_2$). Autophagy is important in cell death decision and can protect cells by preventing them from undergoing apoptosis. In this process, cytoplasmic constituents are delivered to the lysosome which are sequestered with this organelle forming auto-phagolysosomes. It is reported that ROS are among the main intracellular transducers sustaining autophagy.

We hypothesize that a) oxidative stress might be playing a role in apoptosis of larval cells and antioxidant enzymes would protect larva-to-adult cells b) mitochondria being principal source of ROS, *in situ* staining for lysosomes and mitochondria will confirm the cross talk between these two organelles and their role in apoptosis and autophagy during skin morphogenesis.

In the present study, we have carried out localization of anti-oxidant enzymes superoxide dismutase (SOD) and catalase as well as lysosomal marker for autophagy using immunohistochemistry (IHC) and western blot techniques. In addition *in situ* staining for lysosomes and mitochondria is also carried out. Our results indicate increased activity of enzymes SOD and catalase which might be protecting cells from dying and promoting the process of autophagy. IHC for autophagy marker also showed increased activity during the period of climax - transformation of larval skin into adult type. In conclusion, it appears that the mechanisms of antioxidant response and autophagy are simultaneously induced by oxidative stress to decrease damage to the cells and help their survival. Lysosomal mediated autophagy may be partly involved in cell death where organism can degrade and recycle its internal contents to survive short period of starvation during climax of metamorphosis.

## A COMPARISON OF UNFLAVORED AND FLAVORED PRE-WORKOUT SUPPLEMENTS WITHOUT EXERCISE, ON THE EFECT OF WEIGHT AND

## ALT ENZYME LEVELS OF MALE MICE

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Pre-workout supplements are special formulated to boots endurance, help build muscle, increase strength, and burn off fat. With many side effects that are shown through pre-workout, one of the major side effects is loss of liver function. Cellucor CN3 is a popular pre-workout supplement that many people use in the gym and through their physical activities. Each scoop of flavored pre-workout contains five-thousand milligrams and unflavored four-thousand milligrams in which both providing five-hundred milligrams of vitamin C and three-thousand milligrams of Creatine per scoop. During the duration of five weeks of the experiment, male mice were used to determine if pre-workout supplements have an effect on weight and ALT enzymes without exercise. Both flavored and unflavored groups were split into two pairs, one pair receiving a higher dosage than the other pair to see if there would be a major change in weight. The control group was not provided with the pre-workout supplement. After five weeks, with weekly weigh-ins, there was no sign of weight loss and no effect on liver enzymes with both flavored and unflavored pre-workout supplements.

## QUANTITATIVE COMPARISON OF NUCLEAR AND SOMATIC CAMKIV EXPRESSION IN PYRAMIDAL VISUAL CORTEX NEURONS

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Homeostatic plasticity is vital for neuron networks to maintain equilibrium in the face of perturbations. This is accomplished through a series of mechanisms that allow neurons to regulate their firing rates around a stable firing rate set point (FRSP). While this phenomenon is observed both in vivo and in vitro, the process of maintaining a FRSP is not very well understood. Calcium-calmodulin kinase IV (CaMKIV) is suspected to play a critical role in the structure of FRSPs. We hypothesize that a drastic shift in activity beyond the current FRSP results in CaMKIV activation leading to translocation to the nucleus to regulate transcription. To test this, immunocytochemistry was utilized to assess nuclear versus somatic CaMKIV expression and obtain a ratio of the two in vitro in visual cortical pyramidal neurons treated with tetrodoxin (TTX) or bicuculline (BCC). Preliminary data indicates that TTX treated cells exhibit significantly higher nuclear/somatic CaMKIV localization when compared to control cells; however, BCC data indicates no significant difference. Results suggest an inverse relationship between CaMKIV and activity to moderate neuron homeostasis under the TTX condition.

## ROAD SALT EXPOSURE ALTERS SURVIVAL, PHYSIOLOGY, AND REPRODUCTION IN *DAPHNIA MAGNA*

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The application of road salt has been steadily increasing in the United States, which contaminates freshwater ecosystems. Melting snow and ice containing dissolved salts enters rivers through point (sewer drains) and non-point runoff. Freshwater organisms are not physiologically equipped to handle increased salinity concentrations, which can negatively affect individuals, populations, and communities. The goal of this research was to evaluate road salt exposure on adult *Daphnia magna* survival, physiology, growth, and reproduction. Multiple 48 hr $LC_{50}$ (lethal) and 96 hr (sub-lethal) bioassays exposed *Daphnia* to a range of salt concentrations (0,1, 2, 4, 8 & 16 ppt) using individual NaCl and $CaCl_2$ salts as well a 50/50 mixture. A 50/50 mixture of NaCl and $CaCl_2$ is the current formulation applied by the local public works department to roadways. The percent mortality, number of molts, eggs, and heart rate (beats/min) were quantified and compared to controls (N=4-5). In addition, salinity concentrations were monitored at nine sites in a local river system, Loantaka brook, during the summer and winter months using a YSI multimeter. Results from the 48hr exposures determined that $CaCl_2$ was the most toxic to *Daphnia* ($LC_{50}$ = 1.36) followed by NaCl ($LC_{50}$ = 2.87) and the mixture ($LC_{50}$ = 4.69). The decreased toxicity of the mixture compared to the individual salts suggests that antagonism may be reducing toxicity. In the 96 hr sub-lethal bioassay exposure, NaCl, $CaCl_2$, and the mixture significantly increased heart rate ($p<0.05$) compared to control organisms. The frequency of molting in 96 hr salinity exposure displayed an increased trend but was not significantly different from controls ($p>0.05$). The number of eggs non-significantly decreased after 96 hr exposure to NaCl but there was no effect of $CaCl_2$ or the mixture on egg production. In terms of river salinity concentrations, salinity values varied across the sites in Loantaka Brook, ranging from 0.4 to 3.3 ppt with no differences between seasons. Upstream sites located closer to dense urban areas with larger roadways had higher salinity than downstream sites with smaller local roads. However, at all sites, the measured salinity was higher than the EPA freshwater quality criteria (0.23 ppt) but lower than the *Daphnia* $LC_{50}$ values determined by our study for the mixture. Results suggest that salt exposure significantly increases lethality and heart rate with minor increases in growth and decreases in egg production. Further, results confirmed that the specific type of salt applied could significantly alter mortality rate in *Daphnia*. Increased metabolic rate due to salt exposure may increase stress and decrease energy allocation for predator avoidance, foraging, and reproduction, negatively affecting aquatic populations of *Daphnia*.

## ESTABLISHMENT OF TRANSGENIC ANIMAL RESEARCH FACILITY AT UNDERGRADUATE RESEARCH INSTITUTION

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The use of the mammalian animal model for research has allowed for invaluable scientific discoveries throughout the years. For these discoveries to be made, a proper animal facility is necessary to keep experimental animals in a safe and controlled setting, while also providing an environment and the supplies necessary to protect researchers. We, at the Department of Biology, University of Hartford, in recent years has been working to build an animal facility with the aforementioned credentials. We have worked on the adaptation of most updated national animal research regulation guidelines and funding resources. With thorough and thoughtful consideration to other animal facilities and protocols, University of Hartford

faculty and students were able to prepare better living conditions as well as practical protocols to the animal facility. In doing so, the animal facility adopted improved precautions for personal protection equipment (PPE), a designated veterinarian, cemented training methods and a designated invested time in sign in sheets, inventory, and contact list. In great efforts, we successfully set up an efficient animal research facility on campus with limited supplies and conduct research in studying gene function for the causes of osteoarthritis effectively.

In this report, we described facility set up process in details as long as working protocols in the facility of our system. University of Hartford's animal facility had the basics for accreditation, but lacked the essence of a well-working animal facility. The improvements made on the facility, so far, have notably helped increase safety for researchers and the livelihood of the mice. Albeit, there is always room for improvement, future funding could be used to improve climate control and water distribution. Additionally, more scheduling and corroboration, between researchers could be instrumented to further improve efficiency of the animal facility.

## "EGG-CITING" ORGAN RUDIMENT CULTURE: CAM LAYER VS. VITELLINE MEMBRANE FOR THE GROWTH OF A CHICK'S BEAK

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Organ rudiment culture in vitro would provide very efficient method to test factors for organogenesis. Approaches are through culture medium or through nutrients provided through chicken CAM (define CAM here). We compared the chick beak rudiment growth and differentiation by comparing these two culture approaches at the same time. This study has shown significant differences in a period of four days culture observed, the growth of peak growth was slower in culture medium compared to the CAM graft. This result would provide new data for the study of beak organogenesis as well as culture evaluation and selection for organ rudiment cultures.

## BATTLE OF THE WATER FILTERS

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Students from two general biology classes have learned about how devastating waterborne illnesses such as cholera have been in countries such as Haiti and Bangladesh. Various filters, such as sari cloth have decreased the amount of cholera bacteria by up to 70%, We are simulating these experiments by trying to determine which filter makes the best water filter. Cloths such as denim and cotton from a T-shirt, as well as coffee filters and Lifestraw filters have been used to filter water from the Brooklyn Bridge Park, Clove Lake, and a lake in Texas. Serial dilutions were made of filtered and unfiltered water, and samples were plated on nutrient agar or Luria agar. For some samples, McConkey's agar and EMB were used as further differentiators of various bacteria detected. All unfiltered samples tested positive for coliform bacteria, which could be indicative of fecal contamination. Lifestraws have yielded the most promising results. We

will experiment also with biosands in the future.

## A QUEST TO DISCOVER AND IDENTIFY NEW ANTIBIOFILM BACTERIAL COMPOUNDS INHIBITING BIOFILM FORMATION OF PATHOGENIC BACTERIA

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Bacteria growing in a biofilm attached to a surface are protected and resistant to antibiotic treatment and antimicrobial agents. These biofilm forming cells generate an extracellular polymeric substance matrix. Once the biofilm structure has been established, it provides an environment for microorganisms to exchange genetic material between cells and enable them to become resistant to our immune system and antibiotic treatment. Biofilms play an important role in public health. Most infectious diseases and device related infections, such as catheters at hospitals are caused by biofilm forming pathogenic bacteria. New therapeutic approaches are essential as the number of infection caused by biofilm forming bacteria such as *Staphylococcus aureus* and *Staphylococcus epidermidis* has drastically increased. The focus of our research is the identification and characterization of new anti-biofilm substances. Cell free extracts of several bacteria were tested against pathogenic biofilm forming bacteria including *Staphylococcus aureus, Staphylococcus epidermidis Enterococcus feacalis, Lactobacillus casei Acinetobacter baumannii, Bacillus subtilis* and *Pseudomonas aeruginosa*. The extract from *Erwinia carotovora* and *Neisseria Sicca* displayed substantial anti-biofilm activity against several different gram-positive and gram-negative bacteria. Furthermore, some unknown bacteria sampled from the Hudson River around Jersey City were also tested and show strong antibiofilm properties against biofilm forming pathogenic bacteria. Extracts from these bacteria will be further studied to identify and characterize the active compound responsible for the anti-biofilm activity.

## FROM TREE FROGS TO WHALE SONAR: SEEING PATTERNS IN ANIMAL VOCALIZATIONS

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We have used the free-downloadable program Audacity to record tree frogs in the U.S. Virgin Islands and sea lions at local New York City zoos and aquaria. We have analyzed these recordings, in addition to whale sonar recordings available through the Macaulay Sound Library. For example, tree frogs start out vocalizing as one or two frogs and then the sound increases as more frogs join in, then decreases again. This pattern is then repeated. Male sea lions are more vocal than female sea lions, which, in the wild, is a territorial signal during rutting time. Whales emit clicks, perhaps to search for a food source or to identify themselves. We have examined the spectrograms for these vocalizations and determined minimum and

maximum frequencies, and types and numbers of vocalizations. From these patterns, we hope to understand more about how animals communicate.

## EVALUATION OF GUANOFURACIN AS AN ANTIBIOTIC

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Antibiotics are substances made by one microorganism to kill another microorganism. Humans have adapted these natural substances to inhibit the growth of or kill bacteria which cause many infections. However, many pathogenic bacteria are showing increased resistance to commonly used antibiotics, forcing scientists to search for novel ones that may not be naturally occurring. This research project is aimed at further characterizing the potential of one of these compounds, the hydrazone gunaofuracin, as an antibiotic. Typically, the concentration of an antibiotic needed to inhibit the growth of specific bacteria is determined using a minimal inhibitory concentration (MIC) protocol. In a traditional MIC test, serial 1:2 dilutions of drug are made in tubes and then bacteria are added to each tube. Following a period of growth, the extent of cell growth is determined by measuring the absorbance (600 nm) on a spectrophotometer, one tube at a time. In order to optimize space, time, and materials, the MIC assay was miniaturized to a 96-well format. The compound dilutions were performed more quickly using a multichannel pipette and more replicates of the dilutions were able to be performed with less materials. Instead of using a traditional spectrophotometer, a 96-well plate reader was used to take the absorbance measurements of all 96 wells in less than 10 seconds. This miniaturized system was tested using a common antibiotic, ampicillin, which was tested against a lab strain of Staphylococcus aureus known to be ampicillin sensitive. The issues of chemical solubility and stability for guanofuracin are currently being studied while subsequently determining the MIC for guanofuracin against both Gram-positive and Gram-negative species.

## LEVERAGING WHISPERING GALLERY MODES FOR SCATTERING MEDIATED ABSORPTION

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Because light harvested from the sun represents a sustainable and renewable source of energy, light-initiated energetic electron transfer has attracted considerable attention as an emerging paradigm for photocatalysis and solar energy conversion. Solar light initiated energetic electron transfer involves a structure that can efficiently harvest solar photons and invest the energy of the solar photons into high-energy electronic motion. Subsequently, the energetic electrons excited on the harvesting structure deposit energy into nearby molecules, photovoltaic cells, or other energy-accepting materials.

Ideally, structure that can mediate transfer of energy between solar photons and acceptors can be constructed from cheap, safe, and earth-abundant materials.

We conjecture that our proposed Scattering Mediated Hot Electron Transfer (SMHET) phenomena can be leveraged for highly efficient transfer of energy between solar photons and energy accepting materials, and that structures supporting SMHET can be engineered for a variety of applications.

Theoretical and computational methods are being used to elucidate the first step in the SMHET mechanism, which is a process we call Scattering Mediated Absorption. Based on results from rigorous Mie theory and Finite-Difference Time-Domain calculations, we find that light with specific energy content can be efficiently channeled into the metal nanoparticles decorating the surface of the silica core structures, and that the specific energy content can be simply tuned by changing only the radius of the silica core.

## ANTIBACTERIAL PROPERTIES

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Silver is one of the most studied metals in the biomedical field and has applications in the medical, optic and eletical industry. Silver nanoparticles (AgNP) are of particular interest due to their physical properties, which have been shown to strongly influence antimicrobial activity. Our lab used laser ablation in liquid to synthesize AgNPs, giving us the ability to make "bare" particles, free from precursors that are typically associated with chemical synthetic methods. As some pathogenic bacteria form resistances to antibiotics, understanding the mechanisms behind AgNPs antimicrobial activity is paramount. Our main focus is to locate the mutation in a strain of silver resistant (AgR) E. Coli. This willl lead to an understanding of the mechanism which will have its applications into other species.

## VIRTUAL DESIGN AND ANALYSIS OF PARETO OPTIMAL EMITTER STRUCTURES FOR THERMOPHOTOVOLTAIC APPLICATIONS

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The ability to shape the absorption and emission profile of nanostructures by exploiting various resonant phenomena that arise in nanoscale structures has garnered significant interest in designing nanostructured selective emitters for thermal energy conversion applications such as thermophotovoltaics. In this work, we focus on composite planar structures that leverage the interplay between two resonant phenomena that can be realized in simple planar nanostructures: resonant absorption in weakly-absorbing thin films and reflection resonances in multi-layer dielectric stacks (Bragg Reflectors). The interplay between these resonances enables spectral tunability of the composite nanostructures, and yields structures whose thermal emission properties approach the ideal limit of a step-function emitter. We combined rigorous electrodynamics calculations with a virtual screening technique based on Pareto optimality to identify a small number of promising structures from a search space of more than 5 million structures. We identify structures that have a predicted spectral efficiency of 65% and a predicted spectral density of 80000 $W/m^2$.

## MODELING RESONANT ENERGY TRANSFER IN HYBRID NANOPARTICLES

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Hybrid nanoparticles that include noble metal nanoparticles have been a main focus for light initiated generation of energetic carriers for solar energy conversion since the noble metal nanoparticles can accommodate localized plasmon resonances, oscillations of conduction electrons along the surface of the nanoparticle, which makes them ideal for manipulating light flow. We will describe hybrid nanoparticles that are comprised of a dielectric core, which can trap light along the surface, and is surrounded with noble metal particles that can absorb thr light that is trapped by the dielectric core. The properties from the dielectric core slows down the light in the nanoparticle which can induce the phenomena of scattering mediated absorption. Scattering mediated absorption occurs when the dielectric core traps some of the light which propagates in the structure instead of simply passing through the particle. The trapped light can then be utilized to generate hot carriers even in the absence of plasmon resonance, even in low intensities of light.

Rigorous electrodynamics calculations were performed to elucidate the relationship between the size and position of the noble metal nanoparticles on the energy and intensity of scattering mediated absorption. A new model will be developed to solve the Time Dependent Liouville Equation using a density matrix that replicates the energy transport between hybrid nanoparticle donors and small molecule acceptors over time. We will describe our use of this model to understand what conditions maximize energy transfer between the nanoparticles and will allow for other uses of the energy harvested by the light scattering in the hybrid nanostructure.

## ANAYLYSIS OF THE CHARGE MOBILITY IN ORGANIC BATTERIES USING DENSITY FUNCTIONAL THEORY

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Density functional theory (DFT) has been used as a reliable method for making predictions about the properties of molecules and materials. Whether in support of experimental investigations or as a predictive tool, DFT has been successful in determining properties of materials (such as battery materials). We employ DFT to model charge mobility in an organic battery material based on croconic acid salts. The chosen model system is a crystal of sodium or lithium croconate salt. The computational protocol that we developed includes: (1) sampling nuclear configurations from a molecular dynamics (MD) simulation; (2) calculating the electronic coupling for excess electron transfer of a large cluster containing croconate anions, crystal water molecules and the counterions using the Fragment Orbital Density Functional Theory (FODFT) method. Electronic couplings and the so-called site energies (*i.e.*, the binding energy of the excess electron localized on a fragment) are used in a separate calculation using Eisntein's formula to evaluate charge mobility of the excess electron in the crystalline material. Thermodynamical effects are accounted for *via* averaging over thousands of MD snapshots.

## SPLITTING WATER FOR ENERGY WITH MIXED TRANSITION & LANTHANIDE METAL OXIDE PHOTOCATALYSTS

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The water splitting chemical reaction is able to separate water into oxygen and hydrogen. An efficient and economical water splitting process utilizing photocatalysts in direct contact with water would be a key technological component of a much sought after hydrogen economy. However many of the promising catalysts tend to involve expensive metals of the platinum group. The research to be presented will highlight a class of inexpensive transition metal based mixed oxide photocatalysts doped with lanthanide metals that are able to split water into its component chemicals using sunlight. A partly-commercial test apparatus that helps measure the efficiency of the process has also been enhanced and optimized to generate reproducible, consistent, and quantitative measurements of the photocatalytic process.

## SYNTHESIS AND CHARACTERIZATION OF TWO MEROCYANINE SOLVATOCHROMIC PROBES FOR USE IN AQUEOUS SYSTEMS

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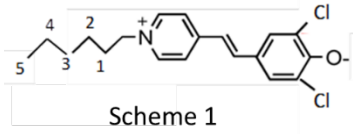
Two merocyanine solvatochromic probes of solvent hydrogen bond-donor-acidity (HBD) with general structure in Scheme 1 ($C_5$ and $C_{10}$) were synthesized, and characterized in accordance with the methods of Taft & Kamlet. UV/vis spectra of the $C_5$ probe collected in aqueous buffers (pH's 4 → 8) show the solvatochromic band (available only for the zwitterionic form of the dye) to be prominent at pH 7.4 enabling us to use the indicator for study of micropolarity in serum albumins (SA). Solvatochromic bands for $C_5$ and $C_{10}$ (alkyl chain length) dyes in 18 solvents show band positions ranging from 440 → 634 nm. Spectra (preliminary) of the $C_5$ probe in aqueous systems suggest that there is no aggregation. A full characterization of these synthesized probes in sample aqueous and non-aqueous media will be presented.



Scheme 1

## ETHYL MODIFIED HYBRID COATINGS FOR CORROSION PROTECTION

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Protection against corrosion is a necessity. The main challenge is replacing the Cr(VI) passivation of metal surfaces with new materials. Melting gels are a new class of materials which fit this requirement. These are organically modified silica based gels that are rigid at room temperature, but begin to soften when heated to 110$^{o}$C. They are consolidated at temperatures above 120$^{o}$C transforming to hybrid glasses, which are excellent corrosion barrier coatings.

This study focused on preparation of hybrid melting gels via a sol-gel method, consisting of ethyltriethoxysilane (EtTES) and diethyldiethoxysilane (DEtDES). The melting gels were prepared over a wide range of compositions between 80%EtDES-20% DEtDES and 50%EtDES-50% DEtDES. It was observed that the temperature of consolidation increased from 120 to 140$^{o}$C with an increase in the concentration of the di-substituted alkoxide DEtDES. The thermal stability of those gels was studied using thermogravimetric - differential thermal analysis (TG-DTA) and differential scanning calorimetry (DSC). The glass transition temperature changes from -41.9 to -64.1$^{o}$C, when the concentration of DEtDES is increased.

Hybrid glass coatings on 304 stainless steel were obtained in two ways. First the melting gels were deposited by directly pouring onto the steel, followed by a thermal treatment at its consolidation temperature. Second the coatings were obtained using electrochemical deposition of the diluted melting gels. The coatings were characterized by FT-IR, which reveals the formation of Si-O-Si and the presence of Si-C bonds, and the results were compared. The tendency to repel water was estimated using contact angle measurements. The contact angles varied between 65$^{o}$ and 93$^{o}$.

In addition, the electrochemically deposited coatings were characterized by cyclic voltammetry, which was run between -0.3 and 0.5V, in order to identify the potentials where reactions occurred. This was followed by chrono-amperommetry at the same applied potential. A reduction potential of ~-0.2 V (against Ag/AgCl) was identified for the melting gels. These results show progress towards the primary goal of this study, which is to produce hermetic anticorrosion coatings.

## THE STUDY OF TETRAMETHYLCYCLOSILOXANES ON SYNTHESIS AND SELF-ASSEMBLY OF SILVER NANOPARTICLES

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Recent years have witnessed a sharp increase in the area of synthesis and mechanistic investigation of controlled self-assembled nanoparticle system because of their applications in energy storage, catalysis and medicine [1]. It has been demonstrated previously that the synthetic methods and stabilizing agents up to certain extent dictate the unique property profiles of the nanoscale materials [2]. We have shown that the reaction condition and reducing agents play a critical role in controlling nanoparticle assembly when generating silver (Ag) nanoraspberries [3]. We were also able to graft such silver nanoraspberries onto multiple surfaces like cotton, activated charcoal and etched glass for medical applications [4].

In this poster presentation, we present our results of the mechanistic investigations to examine the possible

reasons for the self-assembly of silver particles as nanoraspberries. We have performed the reactions of acid catalyzed polymerization of 1,3,5,7 tetramethylcyclotetrasiloxane ($D_4$) without the addition of silver heptafluorobutyrate in order to determine the role of silver in the morphology of the nanoraspberries. It was observed that if $D_4$ nanoparticles were synthesized in presence of heptafluorobutyric acid and not Ag-heptafluorobutyrate, nanoraspberry type structures did not form. We will present the TEM, NMR and IR analysis of the self-assembled siloxanes as well as that of self-assembled silver nanoparticles.


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## THE IMPREGNATION OF NOBLE METAL NANOPARTICLES INTO STÖBER SILICA FOR POSSIBLE APPLICATIONS IN CATALYSIS


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The ability of synthesizing and modifying metal nanoparticles to possess certain characteristic properties makes them desirable because it can be applied to a broad range of applications such as catalysis, sensory applications, optics, electronics, biological and medicinal applications. Metal nanoparticles of sizes ranging from 1-10 nm possess unique properties due to their large surface area to volume ratio, which makes them valuable in applications for catalysis [1]. In nanoscale, silica is chemically and thermally stable nanomaterial with well-defined and controllable morphology and porosity that can tailored for various applications.

In this work, we've explored new silane containing networks that will result in the reduction of metal complexes as well as stabilize metal colloids at nanoscale. This is accomplished by synthesizing noble metal nanoparticles (gold, silver, iron, and palladium) via the reduction and stabilization of their metal salt precursors using n-(2-aminoethyl)-3-aminosilanetriol (2-AST) [2]. Following the synthesis the metal nanoparticles were incorporated into 50 nm Stöber silica under heat and their rate of uptake was monitored via UV-Vis Spectrometer. After the incorporation of the metal nanoparticles into the silica an investigation of their catalytic activity via the reduction of *p*-nitrophenol to *p*-aminophenol was carried out. Collectively the results of the experiment were analyzed using UV-vis spectrometer, TEM, and Infrared spectroscopy.

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## NANOSTRUCTURED $TiO_2$ - HYDROTALCITE COMPOSITES FOR VANILLIN PHOTOCATALYTIC DECOMPOSITION

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Various organic compounds can be decomposed in aqueous solution in the presence of $TiO_2$ powders under irradiation with near ultraviolet light into carbon dioxide and water. The photocatalytic reaction takes place on the surface of the $TiO_2$ particles. When titanium dioxide ($TiO_2$) absorbs ultraviolet radiation from sunlight or is illuminated by a light source, it will produce pairs of electrons and holes. Because oxygen is not strongly adsorbed on semiconductor surfaces in contact with aqueous electrolytes, it is nearly impossible for an electron not to recombine if it remains free on the particle. Consequently, to keep the photooxidation process going, it is necessary to avoid accumulation of the electrons on particles to ultimately avoid their recombination with the holes. Hydrotalcite has a particular structure that is hypothesized to eliminate the rapid recombination of excited electrons/holes during the photoreaction. Hydrotalcite is a lamellar mixed hydroxide, relatively easy and inexpensive to synthesize in the laboratory. Its structure is based on stacking of positively charged layers with anions and water that confers relatively high mobility to the anions. Hydrotalcites are represented by the general formula $[Mg(II)_{1-x}Al(III)_x(OH)_2]^{x+}(A_{x/m})^{m-}\bullet nH_2O$, where $A^{m-}$ is a compensating anion. The $TiO_2$ component of the hydrotalcite–enhanced $TiO_2$ composite has been synthesized using Titanium (IV) isopropoxide, via sol-gel process, whilst the hydrotalcite constituent was generated starting from the corresponding Mg(II) and Al(III) nitrates, in situ, using urea. Composites have been tested for photocatalytic decomposition of vanillin, showing a high conversion rate into carbon dioxide and water. The photocatalytic test reaction was performed under visible light (575 nm), using vanillin as a phenol-model compound. The nanosized composites have been found very effective, displaying high conversion rates of vanillin into carbon dioxide and water.

## A COMPARATIVE ANALYSIS OF VARIOUS METAL NANOCATALYSTS AND THEIR EFFICIENCY CONVERTING *p*-NITROPHENOL TO *p*-AMINOPHENOL

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Metallic nanoparticle received a lot of attention in recent years due to their many interesting and unique properties. Their high surface area and ability to react under mild conditions makes them ideal candidates

to be used as catalysts.[1] Gold nanoparticles in particular have generated a large amount of attention due to their high stability, selectivity, and catalytic activity. This has made them an ideal choice for reductive and transformation reactions in chemical synthesis fields.[2]

In our recent investigations of various noble metal nanoparticle gels, we have found a way to utilize these materials for recyclable catalytic reactions. These hybrid nanogels are a product of successful copolymerization of silica-coated metallic nanoparticles and various functionalized silanes via the Si-OR moieties.[3] The functionalization of these nanoparticles has contributed widely to the stability and activity of the nanoparticle-based structure.

In this work, we present the specific methods of synthesis for gold trimethoxysilylpropyl-polyethylene amine (TMSP-PEI) nanoparticles and hybrid nanogels, including an in depth comparison between the synthesized novel gold hybrid nanogel catalysts and various other metal nanoparticle based catalysts. The array of catalysts will be contrasted for catalytic potential to determine reusability, efficiency, and durability. We will include a detailed comparison of the physical and chemical characteristics of the synthesized gold hybrid nanogels and various published nanocatalyst. An in depth analysis through out synthesis and catalytic reaction using UV-Vis spectroscopy, FT-IR, TEM, and SEM/EDS will be included.

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## PHENYL MODIFIED HYBRID GLASSES FOR ANTICORROSIVE APPLICATIONS

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Hybrid organic-inorganic nanocomposite glasses are a new type of low temperature coating for metal protection. These hybrid glasses are obtained by consolidation of hybrid melting gels. Melting gels are synthesized via a sol-gel process involving a monosubstituted alkoxide such as methyltrimethoxysilane (MTMS) and a di-substituted alkoxide such as methylphenyldimethoxysilane (MPhDMS). Four compositions of melting gels were studied with mole percentages between 70 MTMS:30 MPhDMS and 50 MTMS:50 MPhDMS. The presence of the phenyl group increases the thermal stability of these melting gels by ~100°C with respect to the pure methyl gels. With increasing MPhDMS concentration, the glass transition temperature ($T_g$) decreases from -18.5 to -47.7°C. According to oscillatory rotational rheometry, at room temperature, the gels behave as viscous fluids, with a viscous modulus, $G''(t,\omega_0)$ that is larger than

the elastic modulus, $G'(t,\omega_0)$. When the temperature is decreased, the moduli cross over, and this temperature is recorded as the glass transition temperature $T_g$. The glass $T_g$ measured by DSC agrees well with the $T_g$ determined by rotational rheometry.

The melting gels were deposited on 304 stainless steel samples followed by consolidation. The temperature of consolidation increases from 165 to 182°C with increasing MPhDMS concentration. Through consolidation, the gels are transformed into hybrid glasses. The surface was found to be hydrophobic with a contact angle $\theta > 100^o$. The molecular structure of the hybrid glasses was analyzed using FT-IR spectroscopy. Electrochemical analysis (Anodic Polarization and Electrochemical Impedance Spectroscopy) was performed in 3.5% NaCl solutions.

## IONIC LIQUID MIXTURES WITH SINGLE-WALLED CARBON NANOTUBES AS ELECTROLYTES FOR DYE-SENSITIZED SOLAR CELLS

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There is a great need for the development of renewable green energy sources. In recent years, the use of dye-sensitized solar cells to replace silicon based solar cells have attracted much attention. However, more efficient electrolytes need to be developed to facilitate the increased commercialization of dye-sensitized solar cells. In this comparative study, the properties of single-walled carbon nanotubes (SWNTs) in methylimidazolium ionic liquids (ILs) bearing ether and alkyl side chains were investigated as potential electrolytes for dye sensitized solar cell applications. The ionic liquids were prepared by reaction of 1-methylimidazole with the alkylhalide or alkoxyhalide to yield the halide salt. The halide salt was then converted to the bis(trifluoromethylsulfonyl)amide ($NTf_2$) IL. The structures of the ILs were confirmed using H-1 and C-13 Nuclear Magnetic Resonance (NMR) spectroscopy. SWNT- IL composites were prepared by cost and time efficient microwave irradiation. The conductivity of ILs and SWNT-IL mixtures were measured using a conductivity meter in a low moisture environment. Preliminary, conductivity values greater than 3.0 mS/cm were obtained for SWNT-IL mixtures making them promising electrolytes for electrochemical devices such as dye-sensitized solar cells.

## SYNTHESIS OF HETEROGENEOUS PHOTOCATALYSTS BY COVALENT BONDING OF PHTHALOCYANINES TO FUNCTIONALIZED SILICA

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Heterogeneous reactions advantageously allow the easy separation and reuse of catalysts. Perfluorinated, "non-stick" electron deficient phthalocyanines bind weakly to silica gel *via* van der Waals bonds that do not prevent leaching. We report that a highly fluorinated, amino-functionalized phthalocyanine binds covalently to an acyl chloride functionalized silica. The resulting material retains the phthalocyanine spectroscopic properties while no longer leaching it in organic solvents in which it is otherwise soluble.

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| 8 | HUNTER COLLEGE |
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| 17 | NEW JERSEY INSTITUTE OF TECHNOLOGY |
| 18 | QUEENSBOROOUGH COMMUNITY COLLEGE |
| 19 | RAMAPO COLLEGE OF NEW JERSEY |
| 20 | RIDER UNIVERSITY |

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|---|---|
| 21 | ROWAN UNIVERSITY |
| 22 | RUTGERS UNIVERSITY |
| 23 | St. FRANCIS COLLEGE |
| 24 | St. JOHN'S UNIVERSITY |

## PARTICIPATING INSTITUTIONS CONTINUED

| ENTRÉE | INSTITUTION NAME |
|---|---|
| 25 | SARAH LAWRENCE COLLEGE |
| 26 | SETON HALL UNIVERSITY |
| 27 | STATE UNIVERSITY OF NEW YORK AT NEW PALTZ |
| 28 | SUNY EMPIRE STATE COLLEGE |
| 29 | UNION COLLEGE (Schenectady, NY) |
| 30 | UNION COUNTY COLLEGE, (Cranford, NJ) |
| 31 | UNIVERSITY OF HARTFORD |
| 32 | UNIVERSITY OF HAWAII, HILO |
| 33 | U.S. ARMY EDGEWOOD CHEMICAL BIOLOGICAL CTR. |
| 34 | WILLIAM PATERSON UNIVERSITY OF NEW JERSEY |

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