



**The 8<sup>th</sup> Annual Undergraduate  
Summer Research Symposium  
September 16<sup>th</sup>, 2016**

# 1. Introduction

Eight years have passed since the First Annual Undergraduate Summer Research Symposium. Over this period of time, the School of Science, Technology, and Engineering Management in partnership with Miami Dade College and with the continuous support of the faculty and staff has provided an excellent internship program to our students and those coming from our partner's institutions. From the start the **Carnival Cruise Lines Science and Technology Building** focused on the **hands-on research experience**. This places our students in an



excellent position to gain entrance into graduate, or professional Schools, or to directly enter the workforce in South Florida. Most students in other institutions do not have this research opportunity until they reach graduate school.

The faculty and staff of the School of Science are committed to providing a quality education in the sciences and offer the unique opportunity to talented undergraduate students, to experience hands-on research in ten research laboratories alongside their professors.

In addition, the Summer Research Institute has enhanced the instrumentation capacity of our institution. Such improvements have allowed deepening our research projects as well as to establish new alliances in research and development. Results from our projects already circulate in local, national and international conferences, augmenting this way the visibility of the institution and the pride that students might have for their faculty and work accomplished.

The eight edition of the SRI offered a continuous lecture series "Moving into the Future" on a weekly basis. Ten speakers from University of Miami, Florida International University, and local Technological companies came to St. Thomas to share their wisdom as an in kind contribution.

This year, the memories of the Annual Symposium will be published online in the open source forum MOL2NET. All presentations will be peer reviewed and a DOI number will be assigned. MOL2NET is one of the platforms internationally recognized for scientific exchange.

This annual edition is full of diversity in topics, approaches, and integration of disciplines, representing one of the common paradigms of modern science, inter-disciplinarity, teamwork and networking. I hope you will enjoy the program and the presentations.

Special thanks to our sponsors, Miami Dade College, STEM-TRAC grant, St. Thomas School of Science, Technology, and Engineering Management, Yager Foundation, Monet Coiffure, In Fashion Forever, and Physics & Mathematics Solutions, who provided funding for major and minor activities associated with the 2016 edition.

Dr. David Quesada  
Coordinator of the SRI 2016

## 2. Program Overview

8:00 – 9:00	Registration and Poster Setup. Judges meet in room CCL 111
9:00 – 9:05	Invocation by Rev. Alfred Cioffi
9:05 – 9:20	Opening Comments by Dr. Adrienne Vynne, Dean of School of STEM
9:20 – 9:35	Opening Comments by Dr. Irma Becerra, Provost of St. Thomas University
9:35 – 9:45	Session Introduction by Dr. David Quesada, Coordinator SRI 2016
9:45 – 10:00	Oral Presentation 1
10:00 – 10:15	Oral Presentation 2
10:15 – 10:30	Oral Presentation 3
10:30 – 10:55	Break
11:00 – 11:15	Oral Presentation 4
11:15 – 11:30	Oral Presentation 5
11:30 – 11:45	Oral Presentation 6
12:00 – 13:00	Lunch Break courtesy of the School of STEM
13:00 – 15:00	Poster Session
15:00 – 15:30	Judges meet in CCL 111 to choose the awards
15:30 – 15:45	Announcement of Awards

### **Oral Presentations – Session 1** – Moderator: Dr. Luis Fernandez - Torres

#### **9:45 – 10:00 OP1: The role of putative stem and neural progenitor cell populations following traumatic brain injury in adult zebrafish.**

**Michael Fernando**<sup>1</sup>, Raul Banos<sup>1</sup>, Abdiel Badillo<sup>1</sup>, Martin Oudega<sup>2</sup>, Jeffery Plunkett<sup>1</sup>

<sup>1</sup>School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054 <sup>2</sup> Miami Project to Cure Paralysis, University of Miami Miller School of Medicine, Miami, FL 33136.

Although post-embryonic neurogenesis is limited in the mammalian brain, zebrafish (*Danio rerio*) retain multiple proliferative neurogenic and stem cell niches throughout adult life. The focus of our research is to study how traumatic brain injury (TBI) affects the induction of neurogenic progenitor cell fates in the adult zebrafish brain. We hypothesize that TBI will induce an endogenous, quiescent population of progenitor cells that act to integrate and enable the regenerative response seen following injury in the fish. Preliminary data have shown prior to injury, the putative stem and neural progenitor markers Sox-2, neuroD1 and nestin were expressed around and near ventricular areas of ventral brainstem regions. Furthermore, following 1, 3 and 5 days post-TBI, (focal brainstem injury) an increase in Sox-2, Neurod1 and PCNA immunoreactivity was observed in brainstem regions outside the ventricular location that correlates with the injury site. We are currently examining brainstem regions at 7 days post-TBI and hope to correlate neural-specific gene expression with the migration and differentiation of stem progenitor cells at the injury site.

#### **10:00 – 10:15 OP2: Can DLGAP1 antisense RNA 2 “cure” autism *in vitro*?**

Leana Ramos<sup>1</sup>, Alexis Tapanes-Castillo<sup>1</sup>, Derek Dykxhoorn<sup>2</sup>

<sup>1</sup>School of Science, Technology, Engineering Management, St. Thomas University, Miami Gardens, FL 33054, <sup>2</sup>Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL 33136.

Autism spectrum disorder (ASD) is associated with mutations in genes that affect the balance between neuronal excitation and inhibition. Excitatory neurotransmission in the human brain is primarily mediated by glutamatergic neurons, which express Discs large homolog-associated protein 1 (DLGAP1) post-synaptically. Recent work revealed that individuals with ASD exhibit differences in DLGAP1 RNA levels compared to the general population. The overall goal of our project is to analyze the effect of manipulating DLGAP1 RNA transcript levels in cultured human neurons derived from autistic and control patients. We hypothesize that reducing DLGAP1's non-protein coding antisense RNA transcript 2 (AS2) will rescue some of the abnormal cell biology exhibited by autistic neurons *in vitro*. To test this hypothesis, we used molecular cloning techniques to make a DNA construct containing a short hairpin RNA (shRNA) designed to target DLGAP1 AS2 RNA for degradation. After this construct was made into a lentivirus at the University of Miami, we quantified the number of virus particles produced. In addition, we used specific *in vitro* culturing protocols to grow and differentiate autistic and control (non-autistic) human neural progenitor stem cells into glutamatergic neurons. Future experiments will involve infecting the neurons with the lentivirus to understand the role of DLGAP1 AS2 in autism biology.

### **10:15 – 10:30 OP3: Evaluation of an Autonomous Vehicle Utilizing Self-Adaptive Controller for Obstacle Avoidance**

C. Caro<sup>2</sup>, Y. Lozano<sup>2</sup>, J. Carr<sup>2</sup>, V. Francois<sup>2</sup>, K. Slavina<sup>2</sup>, E. Covach<sup>2</sup>, J. Castillo<sup>1</sup>, J. Armas<sup>1</sup>, and S. Hernandez<sup>2</sup>

<sup>1</sup>Miami Dade College, Miami, FL 33167, <sup>2</sup>School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

Adapting behaviors and operational considerations based on perceptions of environmental dynamics are features of self-adaptive and autonomic systems. This research focused on the evaluation of a self-adaptive system implemented in an autonomous rover to determine the relationship between sensor sensitivity and effector strength. The rover's ability to make decisions based on runtime dynamics to ensure goal attainment (i.e. avoid collisions) in the traversal of unknown tracks, was implemented via a Monitor, Analyze, Plan and Execute (MAPE) loop. The project utilized the MAPE loop to enable the system to autonomously adjust its operational thresholds to perform within desired constraints with little to no human intervention. The inherent challenge with self-adaptive systems is the identification of the internal and external variables that are the most critical factors of system ability to deliver its service at trusted and expected levels. The rover did not know the study focused on the development of a self-adaptive tracked rover to traverse two track tests whose configuration and obstacle distribution a priori. The data collected after the evaluation of the system shows that the speed at which the rover reacts to stimuli detected by its sensors (IR and Ultra Sonic Sensors) is a key internal factor that directly affects all internal and external elements. The data also demonstrated that with 50% percent movement velocity, the rover was able to successfully complete the track tests 50% of the time. When the movement velocity was set to 75% and 100%, the rover was able to complete the track tests 60% and 80% of the time, respectively. Based on the results of the study, we identified that the speed of response to detected change (i.e. the rover's movement velocity), regardless of sensor sensitivity and detection threshold, was the key factor in ensuring runtime goal achievement in obstacle avoidance scenarios.

However, the increased rover movement velocity increases the likelihood of wrong-way completions through the track tests by a factor of 2.

## **10:30 – 10:55 Coffee Break – Grace and Rodger Shay Terrace**

### **Oral Presentations – Session 2 – Moderator: Dr. Alexis Tapanes - Castillo**

#### **11:00 – 11:15 OP4: Solvent Variations of the Briggs-Rauscher Reaction**

Chelsea Trost, Ana Figuereo, Marie Roche, Leonardo Albertini, and Luis C. Fernandez-Torres  
School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

The Briggs-Rauscher (BR) oscillatory reaction is one of the more interesting and colorful oscillatory reactions. It has surpassed the demonstration realm, as it has found use as a method to assess antioxidant capacity. However, this application as an antioxidant assay is limited to water-soluble samples. In the constant search for different, novel applications, we report the effects of various sample solvents on the behavior of the BR reaction. Our investigation looked at how changes in the solvent used to dissolve samples altered the time intervals of BR reaction's oscillations. The solvents used were ethanol, isopropanol, 1-propanol, acetone, and acetonitrile. Addition of ethanol had no effect on the BR oscillations. Isopropanol, 1-propanol, and acetone shorten the oscillation time. A test using acetonitrile discarded solvent polarity effects. Our results suggest that solvents that accelerate the enol pathway rate affect the oscillations of the BR reaction. Finally, samples can be safely dissolved in ethanol and used in the BR reaction.

#### **11:15 – 11:30 OP5: Microbiome analysis of arugula rhizospheres in plants fertilized with vermicompost-based solutions**

Jose Calera<sup>1</sup>, Luis Cendan<sup>1</sup>, Carlos Vazquez<sup>1</sup>, Rachael Karns<sup>2</sup>, D. Pilar Maul<sup>1</sup>, Cole Easson<sup>2</sup>, Jose Lopez<sup>2</sup>.

<sup>1</sup>School of Science, Technology and Engineering Management, St. Thomas University, Miami Gardens, FL 33054. <sup>2</sup>Nova Southeastern University Oceanographic Center, Dania Beach, FL 33004

Vermicompost-based aqueous solutions used as plant fertilizers dramatically increase the number of bacteria, fungi and other microorganisms in the soil. Growers have found that such liquid fertilizers stimulate plant growth and development, and increase pest and disease resistance by promoting beneficial soil bacteria. We conducted an experiment in which the growth of arugula (*Eruca sativa*) plants was positively affected by the use of vermicompost-based liquid fertilizers. In order to identify beneficial bacteria promoted by the various fertilizers, we performed a microbiome analysis of the soil samples. Four liquid fertilizer treatments were used; they differed in the type of additives in the final vermicompost-based solution. Plant growth was determined by measuring height and dry weight of the arugula plants nine weeks after fertilization treatments began. Following DNA extraction from soil samples, PCR was used to amplify the V4 region of the 16S rRNA gene. Sequence data obtained using an Illumina MiSeq were initially processed using MacQIIME version 1.9.1 and clustered into 97% similar Operational taxonomic units (OTUs) using a combination of open and closed reference OTU clustering strategies. The R Studio software (version 3.2.1) with the library "picante" was used to complete the analysis. The results show that the application of vermicompost-based fertilizers

positively affected the composition and richness of bacterial communities in the soil as well as promoted beneficial bacterial growth. Some soil bacterial species particularly abundant after treatments belong to the denitrifying bacterial family Rhodocyclaceae, and to the chemo-heterotrophic family Piscirickettsiaceae.

### **11:30 – 11:45 OP 6: Analysis of Oyster Plant (*Tradescantia Spathacea*) Extracts via Maceration, Soxhlet Extraction and Thin Layer Chromatography**

Daniel Russo, Cristina Balistreri, Kelly O'Reilly, Luis Cendan, Carlos Vazquez, Pilar Maul and Maria Pina

School of Science, Technology and Engineering Management, St. Thomas University, Miami Gardens, FL 33054.

The Oyster Plant (*Tradescantia Spathacea*) is a fleshy or succulent perennial garden herb. This plant is an ornamental plant and found in many tropical countries. Medicinally, the plant is used for colds, sore throat, whooping cough, nasal bleeding, and also as an anti-inflammatory. The plant was grown in the organic garden at St. Thomas University and collected there. All of the plant parts were separated and cleaned up first, and divided into its different parts: leaves, stems, roots, and flowers. The parts were dried two days at 40°C and grinded for wet and dry extraction. The methods included maceration and Soxhlet extraction. Maceration is a type of extraction where the plant materials were placed in different mixtures of solvents, stirred so plant material can be extracted, and left to sit for number of days at room temperature. In the Soxhlet extraction the solvent is heated to reflux, the vapor travels up a distillation arm, and floods into the chamber housing the thimble of solid. The condenser ensures that any solvent vapor cools, and drips back down into the chamber housing the solid material. Soxhlet extraction is done taking the dry material that can be repeatedly washed by a solvent. All the extracts were rot vaped and analyzed using Thin Layer Chromatography with polar and nonpolar solvents. The spots were developed and visualized with iodine and UV light. It has been found that the roots and leaves contain polar and non polar organic compounds. The present work reports the best solvents for extraction, and the better separation was found to be a mixture of 75% ethanol and 25% hexane and 50% ethanol and 50% hexane. Preliminary analysis of extracts using column chromatography and test for inhibition of cancer cell growth were initiated.

**12:00 – 13:00 Lunch – Grace and Rodger Shay Terrace**

## **3. Poster Presentations**

**13:00 – 15:00 Poster Presentations**

### **PP1 – The role of putative stem and neural progenitor cell populations following traumatic brain injury in adult zebrafish.**

**Michael Fernando**<sup>1</sup>, Raul Banos<sup>1</sup>, Abdiel Badillo<sup>1</sup>, Martin Oudega<sup>2</sup>, Jeffery Plunkett<sup>1</sup>

<sup>1</sup>School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054; <sup>2</sup> Miami Project to Cure Paralysis, University of Miami Miller School of Medicine, Miami FL 33136.

Although post-embryonic neurogenesis is limited in the mammalian brain, zebrafish (*Danio rerio*) retain multiple proliferative neurogenic and stem cell niches throughout adult life. The focus of our research is to study how traumatic brain injury (TBI) affects the induction of

neurogenic progenitor cell fates in the adult zebrafish brain. We hypothesize that TBI will induce an endogenous, quiescent population of progenitor cells that act to integrate and enable the regenerative response seen following injury in the fish. Preliminary data have shown prior to injury, the putative stem and neural progenitor markers Sox-2, neuroD1 and nestin were expressed around and near ventricular areas of ventral brainstem regions. Furthermore, following 1, 3 and 5 days post-TBI, (focal brainstem injury) an increase in Sox-2, Neurod1 and PCNA immunoreactivity was observed in brainstem regions outside the ventricular location that correlates with the injury site. We are currently examining brainstem regions at 7 days post-TBI and hope to correlate neural-specific gene expression with the migration and differentiation of stem progenitor cells at the injury site.

## **PP2 – Development of histological techniques and initial analysis of putative stem cell populations following spinal cord injury in adult zebrafish.**

**Melanie Gonzalez**<sup>1</sup>, Kevin Perez<sup>2</sup>, Abdiel Badillo<sup>2</sup>, Martin Oudega<sup>3</sup>, Jeffery Plunkett<sup>1</sup>

<sup>1</sup> Miami Dade College, Miami, FL, <sup>2</sup>School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054; <sup>3</sup> Miami Project to Cure Paralysis, University of Miami Miller School of Medicine, Miami, FL 33136.

Unlike in mammals, zebrafish (*Danio rerio*) are able to re-grow damaged central nervous system (CNS) axons beyond an injury site in the spinal cord. This growth response, which is clearly absent in the mammalian spinal cord, results in overall improvement in spinal cord function in the zebrafish. Furthermore, adult zebrafish retain multiple proliferative neurogenic and stem cell niches throughout life. Our research focus is to study how spinal cord injury (SCI) affects the induction of progenitor cell fates in the adult zebrafish spinal cord. We hypothesize that SCI will induce an endogenous, quiescent population of progenitor cells that act to integrate and enable the regenerative response following injury. In order to analyze spinal cord tissues following complete transection injury, we began our project by developing a paraffin-based histological technique that would allow for precise analysis of damaged axonal tracts and cells within the spinal cord. This technique has allowed us to analyze fluoroemerald-labeled axonal tracts and the putative stem cell marker Sox-2. Initial analysis confirms previously published research findings that stem/progenitor cell populations infiltrate the injury site after three days following complete transection of the spinal cord. More importantly, through our research, we have established methodologies that will allow for a better understanding of the role that stem cells play in the regenerative abilities seen in the CNS of teleost fish.

## **PP3 – The role of CSPGs in neuronal differentiation of stem cells from the adult zebrafish brainstem.**

Andrea Solano<sup>1</sup>, Rayshell Sands<sup>1</sup>, Stephanie Mangels<sup>1</sup>, Abdiel Badillo<sup>1</sup>, Martin Oudega<sup>2</sup>, Jeffery Plunkett<sup>1</sup>

<sup>1</sup>School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054; <sup>2</sup>Department of Neurological Surgery and The Miami Project to Cure Paralysis, University of Miami Miller School of Medicine, Miami, FL 33136.

In the mammalian central nervous system (CNS), neurons fail to regenerate their axon after injury due at least in part to the presence of growth-inhibitory molecules such as chondroitin sulfate proteoglycans (CSPGs). However, in adult zebrafish (*Danio rerio*) certain CNS neuron populations regenerate their axon after an injury in the presence of CSPGs. To investigate the axonal growth response of zebrafish brainstem neurons in the presence of CSPGs, we developed and characterized a unique primary culture system. This heterotypic culture contains neurons, glia, and stem/progenitor cells. Our preliminary *in vitro* data showed the presence of



distinct populations of stem cell-derived neural progenitor cell populations that can differentiate into mature neurons and extend processes into CSPG-rich terrains. In the present study, we investigated a potential role for CSPGs in the differentiation of adult zebrafish brainstem-derived stem cells into neurons. We hypothesized that CSPGs promote the differentiation of stem cells into neurons to enable CNS repair. Using our unique culture system, we examined whether specific concentrations of CSPGs combined with laminin as a growth-promoting substrate play a role in the degree of neuronal differentiation seen after 7 days in culture. Cellular/morphological analysis of CSPG/laminin substrate cultures revealed a more prominent neuronal-like differentiation pattern when compared to a laminin alone substrate condition. Furthermore, immunocytochemical and statistical analysis revealed a phenotypic and quantitative basis for better understanding of the roles of CSPGs and stem cells in CNS regeneration as seen in teleost fishes.

#### **PP4 – The effect of Hedgehog signaling on *in vivo* neuronal morphogenesis.**

Leana Ramos and Alexis Tapanes-Castillo.

School of Science, Technology, and Engineering Management St. Thomas University, Miami Gardens, FL 33054

Neurons exhibit complex and diverse morphologies. The shape of a neuron has important functional implications, as it determines what signals a neuron receives and how these signals are integrated into neuronal circuits. Pharmacological data from mammalian neurons revealed that Hedgehog signaling activity regulates neurite length and branching (arborization) *in vitro*. Based on these findings, we are striving to understand how the Hedgehog signaling pathway regulates neuronal morphogenesis *in vivo*. As a model system, we are studying the multi-dendritic, epidermal sensory neurons of the fruit fly *Drosophila melanogaster*, an organism with evolutionarily conserved mechanisms of neuronal growth and circuit formation. We hypothesize that if we experimentally manipulate Hedgehog signaling activity, we will observe a change in dendritic arborization. Using Sholl Analysis, we are comparing dendritic arborization in larvae with reduced, increased, and control (wild type) levels of Hedgehog signaling.

#### **PP5 – Effect of Brain network topologies on the synchronization of neuronal oscillations – Is this the gateway to the understanding of Central Nervous disorders?**

Natasha Astudillo, Manuel Garcia – Russo, and David Quesada

School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

The Brain Project is aimed at the understanding of the inner working of the brain and how the complex network formed by neurons yields to emergent behaviors at different scales. These varieties of behaviors resulting from the collective action of groups of neurons and cortical areas are hypothesized to be crucial for the comprehension of Central Nervous Disorders (CND) as for example, epilepsy, schizophrenia, Parkinson, Alzheimer, concussion in athletes, and many others. Such conditions seem to appear due to some kind of bottleneck effect while nervous signals spread through the brain wide web. In this communication, we are evaluating the impact of brain network topologies on the synchronization of different neuronal networks. Two approaches are adopted, a microscopic one, addressing the interaction between groups of neurons and following the dynamics of the FitzHugh-Nagumo model, and the mesoscopic one, addressing the interaction between patches in the cortex and following the Kuramoto model, capable to integrate the action of groups of neurons as a whole unit. The relationship between the topological indices characterizing the networks and the attained synchronization is studied.



Results are compared with images obtained from functional MRI (fMRI) and EEG. A potential translation of this research into epilepsy treatment and surgery is addressed also.

### **PP6 – Molecular Cloning of DLGAP1 Short Hairpin RNA Vectors to Study Autism Biology.**

Milagros Mulero<sup>1</sup>, Leana Ramos<sup>1</sup>, Arielis Ortiz<sup>2</sup>, Claudia Martinez Crespo<sup>2</sup>, Derek Dykxhoorn<sup>3</sup>, Alexis Tapanes-Castillo<sup>1</sup>

<sup>1</sup>School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054, <sup>2</sup>Miami Dade College Wolfson Campus, Miami, FL; <sup>3</sup>Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL 33136.

Autism Spectrum Disorder (ASD) is a neurological disorder compromising the behavior and communication skills of affected individuals. The term *spectrum* refers to the wide variety of symptoms and disabilities involved, including learning disabilities, compulsive behavior, and speech delay. Experiments comparing gene expression in autistic and control (non-autistic) individuals found that autism is associated with abnormal RNA levels of DLGAP1 (Discs Large Homolog-Associated Protein 1) antisense 1 and 2. DLGAP1 encodes for a protein expressed at neuronal synapses. The long term goal of our research program is to test how DLGAP1 antisense RNA 1 and 2 levels affect the growth, organization, and activity of autistic neurons *in vitro*. To accomplish this, short hairpin RNAs (shRNAs) designed to degrade DLGAP1 antisense RNAs were inserted into lentiviral DNA vectors using molecular cloning techniques. Six different shRNA containing vectors were created: 3 targeting DLGAP1 Antisense 1 and 3 targeting DLGAP1 Antisense 2. Maxipreps were prepared.

### **PP7 – Culturing Human Neural Stem Cells and Quantifying Lentiviruses to Study Autism.**

Milagros Mulero<sup>1</sup>, Leana Ramos<sup>1</sup>, Vadym Trokhymenuk<sup>1</sup>, Delia Hernandez<sup>1</sup>, Alexis Tapanes-Castillo<sup>1</sup>, Derek Dykxhoorn<sup>2</sup>

<sup>1</sup>School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054; <sup>2</sup>Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL 33136

Autism spectrum disorder (ASD) is partly caused by problems in neuronal communication. Differences in the RNA expression levels of the synaptic protein Discs large homolog-associated protein 1 (DLGAP1) have recently been associated with ASD. The long term goal of this project is to analyze how human neurons react to reduced DLGAP1 antisense RNA levels. To accomplish this, we cultured neural progenitor cells (NPCs) from autistic and control patients. These neural progenitor cells, which were derived from induced pluripotent stem cells that originated from patient skin biopsies, were differentiated towards a glutamatergic fate. In separate experiments, done at the University of Miami, six lentiviruses designed to degrade DLGAP1 antisense RNA transcripts were produced. By generating a standard curve, we quantified the number of virus particles present in each sample. In the future, autistic and control neural progenitor cells will be infected with lentiviruses to analyze how reducing DLGAP1 antisense RNA levels affects autistic cells.

### **PP8 – The seasonality of upper respiratory tract infections and their relationship to asthma.**

Aidin Alejo<sup>1</sup> and D. Quesada<sup>2</sup>

<sup>1</sup> Miami Dade College, Wolfson Campus, Miami FL 33132, <sup>2</sup> School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

The impact of weather conditions on both human health and the spread of diseases is a question addressed by Biometeorology and the answer is very important for health management and disease control. Upper respiratory tract infections due to different viruses (respiratory syncytial virus (RSV), rhinovirus influenza, human metapneumovirus) and bacteria (corynebacterium diphtheriae, chlamidia pneumonia) show seasonal patterns, mostly associated with the changes in the immune response in different seasons. Such infections often trigger asthma episodes that might be difficult to treat, especially in elderly and young children. This project is aimed at describing and modeling the pattern of seasonality in South and Central Florida due to both asthma and upper respiratory tract infections, when each one is considered the primary diagnosis at the Emergency Room (ER). The Department of Health of Florida via the Florida Asthma Coalition provided the health data used in this study. As a result of the statistical analysis, the peak of seasonality for Central and South Florida is centered in late January and early February. Compared with the rest of continental USA, this shift in time is associated with cold conditions arriving to South Florida in these periods. Cold and dry air is affecting the lining of epithelial cells from the respiratory tract in addition to the thermal stress due to the convective loss during respiration. Together, these conditions affect the response of the immune system and facilitate the reproduction of infective agents. A mathematical model based on the SEIR epidemic model is adapted to account for both, recovery from infections and a further development of asthma symptoms. The results might be very beneficial to medical practitioners as well as the pave the way to study potential effects due to global climate changes and the spread of different vector-borne diseases in addition to the spread of allergies.

#### **PP9 – Characterizing Potential Anticancer Properties of the “Medicinal” Oyster Plant *Tradescantia Spathacea*.**

Marissa Lee, Tashani Brown, Carlos Planchart, Milagros Mulero, Leana Ramos, Mang Cing, Vadym Trokhymenchuk, Carlos Canales, Luis Cendan, Pilar Maul, Maria Pina, Alexis Tapanes-Castillo.

School of Science, Technology, and Engineering Mangement, St. Thomas University, Miami Gardens, FL 33054

Natural products, isolated from plants, have been developed into numerous chemotherapeutic drugs and used by millions of patients for cancer treatment. Nevertheless, novel cancer therapies that are more efficient and cause fewer severe side effects are urgently needed. Our aim is to isolate potential new anticancer compounds through bioassay-guided fractionation. The Oyster plant, *Tradescantia spathacea*, has traditionally been used for medicinal purposes. Teas, made from its leaves, are used as home remedies for inflammation and microbial infection. Recent studies provide preliminary evidence that extracts derived from its leaves exhibit anticancer properties. The goal of this project is to test the effects of different Oyster Plant extracts on MCF-7 breast cancer cells cultured *in vitro*. Plant leaf extracts of distinct polarities were made with three different solvents (100% ethanol; 75% ethanol-25% hexane; and 50% ethanol-50% hexane). Each extract was screened at a range of concentrations for cytotoxicity using a MTT cell viability assay. Future experiments will use higher extract concentrations. Moreover, extracts from roots and flowers will additionally be evaluated. Once cytotoxicity data is assessed, extracts will be tested in cell-invasion assays including, adherence, aggregation and migration assays. Any crude extracts discovered to have anticancer properties will then be subjected to further chemical fractionation to isolate active compounds.

### **PP10 – Comparing the Differential Expression of Selected Genes in Native Peruvian Potatoes in Response to Early and Late Drought Conditions.**

Laynet Cornelio<sup>1</sup>, Indira Perez<sup>1</sup>, Carlos Vazquez<sup>1</sup>, Diana Martinez<sup>2</sup>, Olga Patricia Ponce<sup>2</sup>, Emi Murata<sup>2</sup>, Yerisf Torres<sup>2</sup>, Luz Noemi Zuñiga<sup>3</sup>, Gisella Orjeda<sup>2</sup>, Dora Pilar Maul<sup>1</sup> and Carlos Merino<sup>2</sup>.

<sup>1</sup>School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054; <sup>2</sup>Universidad Peruana Cayetano Heredia, Unidad de Genómica, Av. Honorio Delgado 430, SMP, Lima, Perú; Instituto Nacional de Innovación Agraria, Estación Exptal Santa Ana, Real No. 507, El Tambo – Huancayo, Perú.

Plant response to drought stress comprises growth inhibition, stomatal closure, an increase in abscisic acid (ABA) biosynthesis and increased antioxidant metabolism, among others. Drought tolerance in plants is linked to photosynthesis and carbohydrate metabolism. Drought-inducible functional proteins include not only those that protect cells from water deficit and oxidation but those for transcription factors and signaling molecules associated with the water-stress response. Native potatoes from the Andean regions of Peru, Ecuador and Bolivia grow at altitudes as high as 11483 ft. (3500m) above sea level. Because of their high genetic diversity, they are well adapted to the harsh environmental conditions that prevail in the high Andes, including drought. This makes them ideal candidates for gene expression studies associated with drought tolerance. St. Thomas University is collaborating with the Universidad Peruana Cayetano Heredia (UPCH, Lima, Peru), and the Instituto Nacional de Innovación Agraria (INIA, Huancayo, Peru) in a gene expression study in native potatoes associated with early and late drought responses. The first phase of this study, conducted at UPCH consisted on a comparative RNAseq analysis between drought-tolerant and drought-susceptible native potato cultivars. Students from all three institutions then conducted a drought experiment with both tolerant and susceptible native potato species, using an aeroponics growth system at the INIA Experimental station in Huancayo. In the second phase of this study, selected drought-associated candidate genes from the RNA-seq analysis were used in primer design and quantitative RT-PCR (RT-qPCR) analysis. Differential gene expression in tolerant vs. susceptible cultivars has been confirmed for two heat shock proteins, a dehydration-response element binding protein and a protein identified as a major pollen allergen.

### **PP11 – Comparing Primer Sets in Polymerase Chain Reaction Analysis of *Candidatus Liberibacter asiaticus***

Oriana Chacin and Dora Pilar Maul.

School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

Citrus greening, a devastating disease caused by *Candidatus Liberibacter asiaticus* (CLas), is progressively destroying the citrus industry in Florida. Upon infection a plant will eventually produce yellow shoots and develop leaves with a blotchy mottle. Fruits will become lopsided and develop color inversion, making them unmarketable. CLas colonize the phloem of citrus plants damaging the cells in this vascular tissue thus preventing the flow of nutrients to the plant. Currently there is no cure for citrus greening and the only prevention method is to test and remove infected plants to stop the spreading of the disease. The most reliable method to detect CLas is to extract DNA from leaf blades, midribs and petioles and followed by polymerase chain reaction (PCR) analysis. This study aimed to compare some of the CLas-specific primer pairs reported in the literature in order to determine which ones could accurately detect CLas in PCR analysis. Leaf samples from trees showing citrus greening symptoms were collected from different locations in Miami-Dade County. These included *Citrus aurantifolia*, *Citrus sinensis*,

*Citrus aurantium* and *Citrus limon*. The study showed that primers LAS606FWD/LSSREV were better than other primer sets in detecting CLas infection in DNA extracted from both leaf blades and midribs.

### **PP12 – Bacterial Communities Associated with Rhizospheres of Four Organically-Grown Plant Species.**

Andrea Gonzalez and Dora Pilar Maul.

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The rhizosphere, the region of soil in close vicinity to the plant roots, is rich in microbial and soil diversity. Several factors such as, the plant species, the soil type and the root zone location influence the composition of the microbial community in the rhizosphere. The most common rhizosphere bacteria present in soils are the *Pseudomonas* spp. In this study, the microbial community was examined in the rhizosphere of four different species grown in the STU Organic Garden during the spring of 2016: strawberry (*Fragaria ananassa*), okra (*Abelmoschus esculentus*), green onion (*Allium cepa*), and Okinawan spinach plant (*Gynura bicolor*). Our hypothesis was that the rhizospheres of the different species would contain different bacterial community patterns. After extracting DNA from soil samples in the immediate vicinity of the plant roots, both universal and specific bacterial primers were used in polymerase chain reactions (PCR) analyses. Universal bacterial primers showed the presence of bacteria in all four rhizosphere samples. Specific primers to selected soil bacteria did not give positive results, suggesting that these bacterial species are absent or very scarce in the rhizospheres of the species tested in this study.

### **PP13 – Contrasting Effects of Aqueous Vermicompost Extract Mixtures on Growth of *Brassica oleracea* var. *sabellica***

Luis Alfredo Cendan, Carlos Vazquez and Dora Pilar Maul.

School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

Organic fertilizers not only maintain soil fertility but enhance the biological activity of the soil, which improve the efficiency of nutrient use by the plants. Vermicompost, a nutrient-rich organic fertilizer made by composting earthworms can be used in the preparation of aqueous extracts known to increase crop yield and plant health. Vermicompost was produced through cultivation of Red Wiggler worms (*Eisenia fetida*), a common composting species and used in the preparation of aqueous fertilizing mixtures. Kale (*Brassica oleracea* var. *sabellica*), a leafy vegetable known for its high nutritional properties, was grown in the STU organic garden in the spring of 2016. Plants were fertilized with one of three vermicompost-based solutions containing different combinations of organic additives, such as fish emulsion, corn syrup and/or a seaweed blend. Mixtures were prepared weekly and applied, in 4 gal. doses to the plants in each study group twice a week over the course of 10 weeks. Upon harvest, the height, wet weight, and dry weight of the plants were measured. ANOVA and Tukey test analysis showed a significant positive effect on all vermicompost-treated plants compared to the control. Kale plants receiving the mixture T1 (a combination of vermicompost and fish emulsion) resulted in significantly greater height, wet weight, and dry weight in comparison to the other treatments.

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### **PP14 – Bacterial Communities in Arugula Rhizospheres Associated with Vermicompost-based Fertilizers**

Putri Prawita and Dora Pilar Maul<sup>2</sup>.

<sup>1</sup>Miami Dade College North Campus, Miami, FL 33167; <sup>2</sup>School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

Vermicompost, an organic fertilizer made from earthworm castings, promotes beneficial microbes in the soil. Decomposers, nitrogen fixers, aerobes and sulfur oxidizers provide the plants with nutrients and suppress pathogenic bacteria. An experiment conducted at the St. Thomas University organic garden tested the effect of different recipes for vermicompost-based liquid fertilizers (worm teas) on the growth of arugula (*Eruca sativa*) plants. Plants fertilized with worm teas resulted in taller and more vigorous stems. Our hypothesis was that rhizospheres (regions of soil in close vicinity of plant roots) of arugula plants fertilized with different worms teas would contain different bacterial community patterns. After extracting DNA from soil samples using the Powersoil DNA isolation kit (MO BIO labs), both universal and specific bacterial primers were used in polymerase chain reactions (PCR) analyses. We found that bacteria were abundant in arugula rhizospheres treated with all vermicompost teas tested, including the control. Specific primers for *Thiobacillus denitrificans* showed stronger PCR product signals in the control sample than in the vermicompost-treated samples. Specific primers for *Bacillus subtilis*, *Pseudomonas fluorescens*, *Paracoccus denitrificans*, and *Streptomyces lividans* bacteria did not show any signals after PCR analysis, indicating that these bacterial species are absent or very scarce in the arugula rhizospheres.

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#### **PP15 - Microbiome analysis of arugula rhizospheres in plants fertilized with vermicompost-based solutions**

Jose Calera<sup>1</sup>, Luis Cendan<sup>1</sup>, Carlos Vazquez<sup>1</sup>, Rachael Karns<sup>2</sup>, D. Pilar Maul<sup>1</sup>, Cole Easson<sup>2</sup>, Jose Lopez<sup>2</sup>.

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Vermicompost-based aqueous solutions used as plant fertilizers dramatically increase the number of bacteria, fungi and other microorganisms in the soil. Growers have found that such liquid fertilizers stimulate plant growth and development, and increase pest and disease resistance by promoting beneficial soil bacteria. We conducted an experiment in which the growth of arugula (*Eruca sativa*) plants was positively affected by the use of vermicompost-based liquid fertilizers. In order to identify beneficial bacteria promoted by the various fertilizers, we performed a microbiome analysis of the soil samples. Four liquid fertilizer treatments were used; they differed in the type of additives in the final vermicompost-based solution. Plant growth was determined by measuring height and dry weight of the arugula plants nine weeks after fertilization treatments began. Following DNA extraction from soil samples, PCR was used to amplify the V4 region of the 16S rRNA gene. Sequence data obtained using an Illumina MiSeq were initially processed using MacQIIME version 1.9.1 and clustered into 97% similar Operational taxonomic units (OTUs) using a combination of open and closed reference OTU clustering strategies. The R Studio software (version 3.2.1) with the library “picante” was used to complete the analysis. The results show that the application of vermicompost-based fertilizers positively affected the composition and richness of bacterial communities in the soil as well as promoted beneficial bacterial growth. Some soil bacterial species particularly abundant after treatments belong to the denitrifying bacterial family Rhodocyclaceae, and to the chemoheterotrophic family Piscirickettsiaceae.

#### **PP16 – Confirming Huanglongbing in Miami Dade County**

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Huanglongbing (HLB), or citrus greening disease, has already cost millions of dollars in revenue losses to the Florida Citrus Industry. This disease, reported to be widespread in this state, is caused by the bacteria *Candidatus Liberibacter asiaticus* (CLas). HLB affects both citrus fresh fruit and juice, making them unmarketable. Currently there is no cure for HLB. The purpose of this study was to confirm the presence of the disease in Miami Dade County by testing random samples of citrus leaves from residents' backyards. Leaf samples from three different citrus species (*Citrus sinensis*, *Citrus aurantium*, and *Citrus limon*) were collected from different locations within the County. DNA extracted from leaf blades and midribs was used in polymerase chain reaction analysis. Two primer sets were tested: Las606/Lss (L-primers) and OI1/OI2c (Oi-primers), both specific for regions of the CLas 16S rDNA. L-primers successfully detected the bacteria in *C. sinensis* (orange) and in *C. aurantium* (sour orange) but not in *C. limon* (lemon). Oi-primers gave inconsistent results. The results of this study support the hypothesis that citrus greening disease is present in Miami Dade County.

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#### **PP17 – A Comparison of Liquid Organic Fertilizers in the growth of Okinawan Spinach (*Gynura bicolor*), an Asian Medicinal Plant**

Luis Alfredo Cendan, Tiffany Brown, Carlos Vazquez and Dora Pilar Maul.

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Organic and natural fertilizers differ from chemical ones in that they build the soil as they feed the plants. Products made from natural plant and animal materials provide a food source for soil microorganisms and earthworms while at the same time improving the soil structure. Three types of organic fertilizer solutions were used in the growth of Okinawan spinach (*Gynura bicolor*), a popular Asian species grown for its nutritional and medicinal properties. Fertilizer solutions were prepared from compost derived from Red Wiggler worms (*Eisenia fetida*) a popular composting species, as well as from bone meal and fish emulsion, common fertilizers rich in phosphorus and nitrogen respectively. Solutions were prepared weekly and applied to the plants twice a week over the course of 10 weeks. Upon harvest, the height, wet weight, and dry weight of the plants were measured. Statistical analysis consisting of ANOVA and Tukey tests are underway.

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#### **PP18 – Nitrogen Determination Using Kjeldahl Method in Soil and Fertilizer to Grow Okinawa Spinach Plants**

Anne Noel<sup>1</sup>, Karla Rodriguez<sup>1</sup>, Kelly O'Reilly<sup>1</sup>, Myly Fabre<sup>2</sup>, Luis Cendan<sup>1</sup>, Carlos Vazquez<sup>1</sup>, Pilar Maul<sup>1</sup>, Maria Pina<sup>1</sup>.

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Nitrogen is one of the various macronutrients in plants that results from two sources: from the soil and nitrogen from the atmosphere. The nitrogen in soils is released as the mineral decomposes, and the nitrogen from the atmosphere is a component of chlorophyll, a vital process in photosynthesis plants' life. The plants absorb nitrogen from the soil as  $\text{NH}_4^+$  and  $\text{NO}_3^-$ . To increase the productivity rate of plants and minimize potential losses, an enrichment surplus of the nitrogen is supplied using nitrogen-based fertilizers. Other factors such as the timing of the nutrient application has a major effect on the efficiency of nitrogen management systems. It is therefore important to take into account the time and condition in which the

fertilizer was applied. The purpose of the present study was to determine the total nitrogen present in soil and fertilizers by using Total Kjeldhal Nitrogen (TKN) analysis. It involves a preliminary digestion to convert the organic nitrogen to ammonia, then distillation of the total ammonia into an acid absorbing solution, and determination of the ammonia by an appropriate method. The present study was based in the analysis of soil samples from Okinawan spinach plants that were grown in the organic garden of St Thomas University. More than forty samples with and without fertilizers in a period of four week were processed by the Kjeldahl method, including fertilizers and control samples. The results showed poor nitrogen content in the soil samples in general, and the fish emulsion treatment was the best compared to the other two fertilizers.

### **PP19 – Assessment of the impact of micrometeorological conditions on plants growth.**

J. Jean – Jacques, Richard Aponte, and David Quesada

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Global climate changes and the acceleration of urbanization all over world constitute a serious problem for the health of soils, the microbiome inhabiting in them, and ultimately to the agriculture. Intensive agricultural practices have increased the use of industrial fertilizers, which in many cases remediate only temporarily and affect in the long term the soil biochemistry. In this communication, the assessment of the impact of the outdoor temperature and humidity around the organic garden located within the St. Thomas University forest is performed. An evaluation of the micrometeorological conditions using mobile sensors from Pasco and how they compare with meso-scale measurements using the automated weather station operated with Earth-Networks (Weatherbug) is done. Such studies are aimed at evaluating the impact of micrometeorological conditions of the effectiveness of artisanal soil in growing Okinawa spinach.

### **PP20 – Spectrophotometric Iron Determination in Organic-Fertilizer Treated Soil Analyzed Using 1,10-Phenantroline Method**

Kelly O'Reilly, Cristina Balistreri, Daniel Russo, Luis Cendan, Carlos Vazquez, Dora Pilar Maul and Maria Pina

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Iron metal belongs to the group of the so called bioelements because its presence is necessary for normal development of the living organisms. Iron is defined as a micronutrient due to low concentrations in soils. It is one of the crucial elements necessary for a plants' life. It is absorbed through the roots from the soil. Iron assists in the movement of important elements through a plant's circulatory system; therefore, iron is responsible for the respiration and photosynthesis activities. Additionally, it is utilized in the formation of chlorophyll and proteins.. Fe ions are present in two states of oxidation in the atmosphere:  $\text{Fe}^{+2}$  and  $\text{Fe}^{+3}$ . The purpose of this experiment was to determine the amount of iron in different soil samples from St. Thomas University's Organic Garden. So far, there have been no investigations on the content of iron in the soil of the allotment organic garden and the present work is a part of a research project the study several macro and micronutrients contents. Iron (II) reacts with o-phenantroline to form a coloured complex ion. The intensity of the coloured species is measured using a Spectronic 301 spectrophotometer. A calibration curve (Absorbance versus concentration) is constructed for Iron (II) and the concentration of the unknown iron samples is soils is determined. The original



samples of soils are taken from fertilized and non fertilized pots of Okinawa spinach plants. Preliminary Fe(II) content is reported for control, fertilizers, and organic-fertilized treated soil samples during one to four weeks.

### **PP21 – Mighty Fruits: Antioxidant Performance of Various Fruits**

Jason Alvarodiaz, Jennifer Cerda, Christine Curiac, and Luis C. Fernandez-Torres  
School of Science Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

Antioxidants help fight free-radicals, which are produced by stress and later can induce many health problems. L-Ascorbic acid (Vitamin C) is a great antioxidant, and it can be found in a vast variety of fruits. Additionally, vitamin C is marketed as an over-the-counter remedy for the common cold. This motivates our desire to understand vitamin C's antioxidant properties. This investigation presents the antioxidant capacity of various fruits that are known to be sources of vitamin C, and their comparison to pure vitamin C using the Briggs-Rauscher (BR) oscillatory reaction. The antioxidant species scavenge free radicals formed in the BR reaction, lengthening the time intervals of the reaction's oscillations; the higher the antioxidant capacity, the longer the oscillation delays. The samples that were tested were: L- Ascorbic acid, Sunny-D®, red grape juice, white grape juice, pineapple juice with pulp, pineapple juice without pulp, mango juice, and kiwi juice. Pure vitamin C could only be tested at low concentrations, as high concentrations completely interrupt the BR reaction. Kiwi exhibited the best antioxidant capacity of the tested samples, followed by mango juice. The antioxidant performance of orange juice resembled that of vitamin C the most. This result suggests that vitamin C is the main antioxidant present in orange juice. The other fruits exhibited antioxidant performances different to pure vitamin C. We ascribe these observations to the presence of other molecules, such as flavonoids and tannins, which also show antioxidant capacity.

### **PP22 – Structure – Activity Relationships (SARs) of Antioxidant Molecules**

Luis E. Castellar, Langeda Bontemps, Leslie Robinson, and Luis C. Fernandez-Torres  
School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

The public's demand for antioxidant supplements has increased recently. As more of these supplements hit the market, an understanding of what makes a molecule a good antioxidant is paramount. The aim of this research project is to evaluate the antioxidant capacity of several phenols and related derivatives using the Briggs-Rauscher (BR) oscillatory reaction. The antioxidant species scavenge free radicals formed in the BR reaction, lengthening the time intervals of the reaction's oscillations; the higher the antioxidant capacity, the longer the oscillation delays. In phenol structures, the amount of hydroxyl (OH) withdrawing groups affects the antioxidant capacity. By adding a hydroxyl group in a specific ring position, such as *ortho* or *para*, an increase of antioxidant capacity was observed. Previous research supports that *ortho* substitution of an electron donor increases the stability of the phenol radicals. Our results showed that *meta* substituted phenols were the most active antioxidants. We rationalize this observation by considering the low pH (~2) of the Briggs-Rauscher reaction. It was also noticed that a monophenol showed less antioxidant capacity than a polyphenol structure. Finally, we observed that the number of OH substituent does affect the antioxidant capacity.

### **PP23 – Powerful Plants: Antioxidant Capacity of Selected Plants**

Christine Curiac, Jason Alvarodiaz, Langeda Bontemps, Luis Castellar, Jennifer Cerda, Ana Figuereo, Chelsea Trost, and Luis C. Fernandez-Torres

School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

Different cultures from around the world have used plants from their natural surroundings to treat different ailments. The action mechanisms of these natural remedies are diverse, yet many studies suggest their antioxidant properties bring about their effectiveness. This project presents the determination of the antioxidant capacity of selected plants, and comparing those results to a Trolox standard. The Briggs-Rauscher (BR) oscillating reaction was used to determine the antioxidant capacity of the samples. The antioxidant species scavenge free radicals formed in the BR reaction, lengthening the time intervals of the reaction's oscillations; the higher the antioxidant capacity, the longer the oscillation delays. The samples consisted of aqueous and ethanolic extracts from the leaves of *Annona muricata*, *Moringa oleifera*, *Petiveria alliacea*, *Hamelia patens*, and *Gynura bicolor*. To analyze the results we used the Relative Antioxidant Performance (RAP), where the slopes of the samples were compared to the Trolox standard. Since most of these leaves are traditionally used in teas, we hypothesized that the aqueous extracts would exhibit the highest antioxidant capacity. Except for the aqueous extracts of *Moringa oleifera* and *Petiveria alliacea*, our hypothesis was proven correct, with *Hamelia patens* showing the highest RAP. These results were attributed to the solubility in water of the active antioxidant molecules versus their solubility in ethanol. These observations suggest that antioxidant properties are present, and could be a plausible pathway to their therapeutic properties. Furthermore, these extracts are complex mixtures of natural ingredients; therefore, we should not dismiss any potential synergistic effects between different ingredients.

#### **PP24 – Antioxidant Capacity of Common Dietary Supplements**

Ana Figuereo, Marie Roche, Leonardo Albertini, Chelsea Trost, and Luis C. Fernandez-Torres  
School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

Today's health-conscious society consumes a wide variety of dietary supplements in order to improve quality of life. An increasing number of these supplements are marketed as antioxidants. Therefore, it is of great importance to understand the performance of these supplements as antioxidants. This investigation presents the antioxidant capacity of several common dietary supplements using the Briggs-Rauscher (BR) oscillatory reaction. The antioxidant species scavenge free radicals formed in the BR reaction, lengthening the time intervals of the reaction's oscillations; the higher the antioxidant capacity, the longer the oscillation delays. The samples experimented, Beta carotene, Lutein, Quercetin, Folic Acid, and L-Glutathione, all exhibit antioxidant activity. Trolox, a water-soluble form of vitamin E, was established as the standard to assess each supplement's antioxidant capacity. It was noted that the time delay within the BR reaction oscillations was significantly affected with increasing concentrations of each substance. Also, sodium iodate proved to be better than potassium iodate in the BR reaction, as precipitation was not a factor that altered results in the BR reaction. In addition the antioxidant capacity was quantified by the calculation of the Relative Antioxidant Performance (RAP), which measures the sample slope over the standard slope or the slope of Trolox. Finally, we observed that exposure to light can affect the antioxidant capacity.

#### **PP25 - Antioxidant Capacity of Selected Teas and Cocoa**

James Hankemeyer, Kasey Rivera, Kelnisha Lightbourne, Sara Salamah, and Luis C. Fernandez-Torres

School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

Diverse teas are consumed around the world for their calming, soothing effects. Many people attribute curative properties to tea. The same can be said for cocoa, and its processed form chocolate. Furthermore, these attributed health-giving properties are suggested to come from their antioxidant properties. This study presents the determination of the antioxidant capacity of selected teas (*Camellia sinensis*) and cocoa (*Theobroma cacao*), and comparing those results to a caffeine standard. The Briggs-Rauscher (BR) oscillating reaction was used to determine the antioxidant capacity of the samples. The antioxidant species scavenge free radicals formed in the BR reaction, lengthening the time intervals of the reaction's oscillations; the higher the antioxidant capacity, the longer the oscillation delays. The samples consisted of aqueous preparations of Green tea, Black tea, Cocoa (pure powder), and Dark chocolate. To analyze the results we used the Relative Antioxidant Performance (RAP), where the slopes of the samples were compared to the caffeine standard. We hypothesized that the aqueous preparations of the samples would exhibit antioxidant capacity. Our hypothesis was proven correct, with green tea showing consistently higher RAP than decaffeinated green tea, and dark chocolate exhibiting slightly more antioxidant capacity than pure cocoa powder. Black tea proved to be less antioxidant than green tea. These observations suggest that antioxidant properties are present, and could be a plausible pathway to their attributed health-giving properties. Finally, these preparations are complex mixtures of natural ingredients; therefore, we should not dismiss any potential synergistic effects between different ingredients.

## **PP26 - Determination of the Antioxidant Capacity of Coffee**

Kelnisha Lightbourne, Sara Salamah, James Hankemeyer, Kasey Rivera and Luis C. Fernandez-Torres

School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

Coffee (*Coffea arabica*) is one of the most consumed drinks in our society. It is grown in many regions around the world, developing different flavors and aromas. Its active ingredient, caffeine, is sought after for its stimulating properties, and purported therapeutic effects. This study presents the determination of the antioxidant capacity of coffee, and the assessment of those results using a caffeine standard. The Briggs-Rauscher (BR) oscillating reaction was used to determine the antioxidant capacity of the different coffee samples. The antioxidant species scavenge free radicals formed in the BR reaction, lengthening the time intervals of the reaction's oscillations; the higher the antioxidant capacity, the longer the oscillation delays. The samples consisted of caffeine (5%), and freshly brewed samples of espresso coffee (1%), decaf (1%), Costa Rican coffee (5%), Cuban Split Pea Blend (1%) and Jamaican Blue Mountain Coffee (5%). All samples show antioxidant capacity. To analyze the results we used the Relative Antioxidant Performance (RAP), where the slopes of the samples were compared to the caffeine standard. Jamaican Blue Mountain Coffee exhibited the highest RAP at the 5% dilution; Cuban blend was the highest RAP at the 1% dilution. To further examine the Cuban blend, we tested roasted split peas (10%), and they showed no antioxidant capacity. These observations suggest that antioxidant properties are present in coffee, and could be an explanation to its attributed health-giving properties. Finally, brewed coffee is a complex mixture of natural ingredients; therefore, we should not dismiss any potential synergistic effects between different ingredients.

## **PP27 – Braess Paradox in Electrical Networks – When more might mean less**

J. Rojas, A. Alonso and D. Quesada

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Electrical grids are part of the network of connections maintaining a city alive nowadays. Many times we see a limited amount of lines and poles, as well as, supportive local electrical transformer points (LETP). Most of these connections are wired in parallel in order to guarantee a sustainable flow of electricity plus being robust enough against failures. Why are we not making the system redundant and increasing the number of grid points and cabling? How the performance of a power grid network can be assessed from its connectivity pattern? In this presentation the Braess Paradox is investigated for several network configurations. Special interest is dedicated to the Wheatstone bridge and to those networks containing such configurations as part of their structural elements. The flow across the network as well as the overall resistance are computed and expressed in terms of network characteristics. In answering the first question, we hypothesized that despite of the economic cost of such approach there is a counter intuitive fact known as the Braess Paradox, which states that in a congested network, it may happen that adding a new path between destinations can increase the level of congestion. In transportation networks, the phenomenon results from the decisions of network participants who selfishly seek to optimize their own performance metrics. In an electric power distribution network, an analogous increase in congestion can arise as a consequence of Kirchhoff's laws. To address the second question, we also hypothesized that power grid performance might be assessed through a combination of indices characterizing networks and enabling quantify the easiness of connecting two distant points by walking the shortest path. The results obtained from executing these methods included: power grids can be mapped into networks of vertices (hubs) and edges (connecting lines); power grid networks can be studied through the Adjacency Matrix, Geodesic Paths, and Clustering coefficient; electrical networks behave similar to Road networks. In both cases, the addition of extra links (roads, connecting lines) yields to overloads and a detriment in performance. This fact is known as the Braess Paradox; for every network there is a critical value of edges above which, any addition does not introduce any improvement in performance; intelligent Dashboard can be implemented to control the performance of the power grid in parallel to the management windows.

## **PP28 – Mathematical Modeling of the Optical response of photovoltaic cells**

H. Morales<sup>1</sup> and D. Quesada<sup>2</sup>

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With the perpetual depletion of fossil fuels, the rising of global temperatures as a result of CO<sub>2</sub> emissions, and the desire to have an independent source of renewable energy, photovoltaic cell (PVC) research has been on the rise. One of the main obstacles for the PVC industry is the efficiency of conversion of the systems currently in use. Traditional PVC employed single-band-gap semiconducting materials that used a very specific portion of the solar spectrum. The last fact explains the low conversion efficiency of such PV cells. Materials science and nanotechnology brought into the table multilayered tandem PV cells with different band-gaps per layer. This way, a wider portion of the solar spectrum has been utilized. Record efficiencies nowadays are around 40 % but only under laboratory conditions, whereas most commercial PVC is around 25 %. Quantum Dots (QD) represents another group of potential enhancers of conversion efficiencies. They might be prepared with different sizes and therefore multiple band-gaps might be obtained. Additionally, their nanostructured nature would permit to take

advantage of Plasmonic effects operating at these scales. In this presentation the optical response of quantum dots (QD) composites is explored as a viable and potential new technology. Different configurations of dispersed QD within the host matrix are presented and compared with experimental realizations. The limitations of this approach are analyzed and future directions are envisioned.

### **PP29 – Belousov – Zhabotinsky Reaction: Effects of Magnetic Field Variations**

Amanda Penton, Brandon Gamboa, David Quesada, and Luis C. Fernandez-Torres

School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054

The Belousov-Zhabotinsky (BZ) reaction is a classical oscillatory reaction that is the subject of many studies. One of its applications is to model other oscillatory processes, such as circadian rhythm. More often than not, experiments done on people are impractical, thus requiring simulations or modeling to enlighten the world on the unknown. A study of the effects of magnetic fields on the BZ reaction is presented. Magnetic fields create a huge impact on our lives, so much so that without them we may not function properly. It is not practical to expose people to diverse magnetic environments, such as outer-space, since an assay that assesses this requires multiple readings as well as the ability to allow another person to do it. Therefore, the Belousov-Zhabotinsky reaction, a Helmholtz coil, petri dishes, and a timer were used to provide clues as to how magnetic fields affect oscillating reactions. Our results indicate that the BZ reaction is a good model to replicate oscillatory biological reactions. Furthermore, the experimental conclusion is that reactions exposed to strong magnetic fields will oscillate slower than those exposed to weak magnetic fields.

### **PP30 – Modeling the oscillating Belousov – Zhabotinsky chemical reaction**

Steven Centeno<sup>1</sup> and David Quesada<sup>2</sup>

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Chemical reactions play a fundamental role in many processes in nature and life. At the same time, some of these reactions serve as a prototype for new technological applications ranging from biotechnology to quantum information. In this presentation, the kinetics of the well-known Belousov-Zhabotinsky oscillating reaction is studied. The choice of this particular reaction came from its similitude with circadian rhythms and the molecular clocks involved in the human response to microgravity conditions and the presence of electro-magnetic fields. The last facts are important for future deep space travels, as for example, the Mars program. Starting from first principles, chemical reactions often involve three components, diffusion, reaction and convection. The first two components are unaffected by the presence of external fields, while convection is strongly affected by temperature gradients, magnetic and electric fields. Additionally, when reactions occur in confined geometries, the interplay of all these factors lead to the formation of spatial self-organized structures, known as Turing instabilities. In the present communication, the chemical kinetics is modeled as a system on nonlinear differential equations following the scheme NKF. Critical points and conditions of stability are obtained, as well as the conditions leading to an oscillatory behavior. Since the study limited to the kinetics only, convection effects were neglected cause the influence of the magnetic field on the reaction could not be addressed. Even though a system of partial differential equations will include such effect, in this communication, a possible explanation for the Magnetic Field Effect (MFE) is advanced and is in qualitative agreement with experiments performed by a research team from the School of STEM at St. Thomas University.

### **PP31 – Initial Description of the Local Ionospheric Response to Geomagnetic Storms**

Santiago Mejia<sup>1</sup>, Ali Khan<sup>1</sup>, and Eduardo A. Araujo-Pradere<sup>2,3</sup>

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Geomagnetic Storms are planet-wide disturbances of the Earth's magnetic field. These storms are closely related with solar activity events, and could have catastrophic effects on systems such as satellites, GPS systems, loss of electrical power, and irreversible damage to transformers and power stations. The overall objective of this project was to describe the response of our local ionosphere (described by foF2 and TEC) to geomagnetic activity (index ap), which depends on solar activity events. To fulfill our objective in this project, we used ionospheric data for TEC, foF2, and geomagnetic ap index for year 2015. The quiet values for foF2 and TEC were generated from the IRI (International Reference Ionosphere), with the latitude and longitude coordinates corresponding to St. Thomas University, FL. The foF2 disturbed values were obtained from the iono-sounder at the Eglin Air Force Base (EAFB). The TEC disturbed values and geomagnetic ap index were downloaded from the NGDC database (NOAA's National Geophysical Datacenter). Each event is identified when ap values reached or went over 100 nT, resulting in 6 independent events being recorded. Finally, we created a script to organize and compare our values. We found that for Equinox and Summer events (1 to 5), the ionospheric parameters suffer a depletion when compared with the quiet reference, indicating a more active recombination process due to the presence of fresh molecular mass. For winter conditions (Event 6) the ionospheric parameters increase over the quiet mean, corresponding with a prevalence of atomic elements, resulting in a less predominant recombination process. These results agree with previously published studies of mid to mid-low ionosphere.

### **PP32 – Cube Quest Challenge**

Javier Rojas<sup>1,\*</sup> and Monsi Roman<sup>2</sup>

School of Science, Technology, and Engineering Management, St. Thomas University, Miami Gardens, FL 33054, \* Internship at NASA Marshall Space Flight Center,<sup>2</sup> Marshall Space Flight Center, Huntsville, AL 35808.

The area of emphasis for this project is to develop products that support Centennial Challenges' technical development needs by creating a comprehensive communications strategy, maintaining a compelling web presence, and public engagement activities to recruit teams. This project will present a comprehensive approach to promoting the Cube Quest Challenge, including website improvements, technology development and transfer, commercial applications, social media, exhibits, public engagement, creating a new-competitor package, and post-challenge resources.

## 4. Judging Rubric

### Summer Research Institute 2016 Evaluation Rubric

**Title of the presentation:**

**Authors:**

<b>Type of Presentation</b>	<input type="checkbox"/> Oral <input type="checkbox"/> Poster
<b>Content Area</b>	<input type="checkbox"/> Biology / Botany <input type="checkbox"/> Chemistry <input type="checkbox"/> Computer Science <input type="checkbox"/> Mathematics <input type="checkbox"/> Physics <input type="checkbox"/> Engineering
<b>1. Content of the Presentation</b>	<b>Scale (0 to 10)</b>
How clear the problem was stated?	
How original is the solution?	
What is the scientific merit of this study?	
<b>Subtotal</b>	
<b>2. Organization of the Presentation</b>	<b>Scale (0 to 10)</b>
How well the presentation is structured?	
How readable the fonts were?	
Do the graphs are labeled?	
Balance between writing, graphs, and tables	
Are conclusions included?	
Are limitations and errors of the study discussed?	
Are references included?	
<b>Subtotal</b>	
<b>3. Presentation skills</b>	<b>Scale (0 to 10)</b>
How well the time was managed?	
How fluid the presenter was?	
How knowledgeable the presenter was?	
How reachable the presenter was?	
<b>Subtotal</b>	
<b>Total</b>	

**Name of the Judge:** \_\_\_\_\_



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